Programs in English

- Mechatronics Engineering
- Mechanical Engineering
- Electronics Engineering
- Electrical Engineering
- International Economy and Trade

Content

Mechatronics Engineering

Educational Objectives

Mechatronics engineering is a multidisciplinary field of science that includes a combination of mechanical engineering, electrical engineering and control engineering. Rather than embrace traditional divisions of engineering as distinct entities, this is a degree that embraces the interdisciplinary area of mechanical engineering, control engineering and software development, especially for controlling sophisticated smart machines. Mechatronics engineering program teaches students to design and build computer controls for mechanical systems and machines like hybrid vehicles and robots. Additionally, the bachelor's program combines advanced engineering studies with projects that provide real-world experience in a variety of technologies and fields.

Core Courses

1. Common basic courses

Calculus, Physics, Chemistry, Linear Algebra, Probability and Statistics, Computer Science and Programming

2. Specialized basic courses

Theoretical Mechanics, Mechanics of Materials, Analog Electronics, Principle of Digital Logic and CPU, Theory of Machines and Mechanisms, Machine Design, Microprocessor Systems and Assembly Language, Signals and Systems

3. Specialized courses

Progress on the Discipline of Robotics, Introduction to Robotics, Innovation Practice-Mechatronic Systems, Innovation Practice-Intelligent Robots, Mechatronic Control Technology, Sensing and Testing Technology, Digital Image Processing, Computer Software Practice-Mechatronics

Program Outcomes

Students graduate with unique abilities in the full spectrum of smart machine design. Among the skills acquired is the development of autonomous systems such as self-operating robots, vehicles, as well as a thorough knowledge of industrial automation.

The graduates are able to solve the mechanical and electrical system engineering problem and to communicate effectively with the industry peers and the social public communication, including designing documents and writing reports, giving presentations and responding to commands. Furthermore, the graduates will have a certain international vision and communication ability in a cross-cultural circumstances.

Duration and Degree

4 years, Bachelor Degree of Engineering in Mechatronics Engineering

Curriculum

Semester 1			Credits
100172103	工科数学分析 I	Mathematical Analysis for Engineering I	6
101190003	大学化学 C	General Chemistry C	2
101080081	计算机技术与编程	Computer Science and Programming	3
100245105	国际交流英语 I	International English Communication I	2
100230057	知识产权法基础	Practical Administrative Law	1
100270001	思想道德修养与法律基础	Ideological and Moral Cultivation and Basics of Law	3
100980001	军事理论	Military Theory	1
100980002	军事训练	Military Training	1.5
100320001	体育 I	Physical Education I	0.5
100160501	生命科学基础 A	Principle of Life Science A	2
102172501	线性代数 A	Linear Algebra A	3.5
100930001	大学生心理素质发展	Psychological Quality Development of College Students	1
Total Hours			**26.5**

Semester 2			Credits
100172203	工科数学分析 II	Mathematical Analysis for Engineering II	6
101037302	工程制图	Engineering Graphics	4
100270002	中国近现代史纲要	The History of Modern China	2
101180111	大学物理 I	College Physics I	4
100180116	物理实验 B I	Physics Laboratory B I	1
100245106	国际交流英语 II	International English Communication II	2
101080082	C 语言编程实践	C Programming Practice	1
101062219	电路分析基础实验 A	Electric Circuit Experiment A	1
101062102	电路分析基础 A	Fundamentals of Electric Circuit A	3.5
100320002	体育 II	Physical Education II	0.5
Elective	通识教育选修课	General Electives	2
Total Hours			**27**

Semester 3			Credits
101013001	理论力学	Theoretical Mechanics	4
100172003	概率与数理统计	Probability Theory and Mathematical Statistics	3
101180121	大学物理 II	College Physics II	4
100180125	物理实验 B II	Physics Laboratory B II	1
100172001	复变函数与积分变换	Complex Variables and Integral Transform	2
100051294	电子实习	Electronic Practice (Radio Installation)	1
100270003	马克思主义基本原理概论	Introduction to Basic Principles of Marxism	3
100320003	体育 III	Physical Education III	0.5
101062104	模拟电子技术基础	Analog Electronics	3.5
100062203	模拟电子技术实验 A	Analog Electronics Experiment A	0.75
Elective	通识教育选修课	General Electives	2
Total Hours			**24.75**

Semester 4			Credits
101037304	机械原理	Theory of Machines and Mechanisms	3
101037305	工程材料与应用	Principle and Application of Engineering Materials	3
100270004	毛泽东思想和中国特色社会主义理论体系概论	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics	4
101014001	材料力学	Mechanics of Materials	3.5
100320004	体育 IV	Physical Education IV	0.5
102027101	机器人学科前沿与发展动态	Progress on the Discipline of Robotics	1
102027102	创新创业实践-机电系统综合实践 I	Innovation Practice - Mechatronic system I	2
102027103	微系统设计与制造	Micro-electro-mechanical System Design and Fabrication	2
Elective	通识教育选修课	General Electives	2
Total Hours			**21**

Semester 5			Credits
101037307	机械设计	Machine Design	3
101037303	科学研究与写作	Research Methods and Academic Writing	1
101037308	机械设计综合课程设计	Machine Design Project	2
101037313	制造技术基础训练	Basic Training of Manufacturing Technology	2
101063107	数字逻辑与 CPU	Digital Logic Circuit and CPU	5
102027104	信号与系统	Signals and Systems	3.5
102027105	创新创业实践-机电系统综合实践 II	Innovation Practice - Mechatronic system II	2
100270005	社会实践	Social Practice	2

Total Hours

Semester 6			Credits
102027106	机电控制技术	Mechatronic Control Technology	3
102027107	传感与测试技术	Sensing and Testing Technology	3
102027108	微处理器与汇编语言	Microprocessor Systems and Assembly Language	3
102027109	创新创业实践-智能机器人综合实践 I	Innovation Practice - Intelligent Robots I	2
102027110	机器人学	Introduction to Robotics	2
102027111	高频电子电路	High Frequency Electronics	3
102027112	计算机软件实践	Computer Software Practice-Mechatronics	2
Total Hours			**18**

Semester 7			**Credits**
102027113	数字图像处理	Digital Image Processing	3
102027114	生产实习	Internship in Industry	3
102027115	创新创业实践-智能机器人综合实践 II	Innovation Practice - Intelligent Robots II	2
102027116	测量与虚拟仪器设计	Measurement and Virtual Instruments	3
Total Hours			**11**

Semester 8			**Credits**
102027117	毕业设计（论文）	Graduation Project (Thesis)	12
Total Hours			12
Total Credit Hours			**160.75**

Course Descriptions

101013001 Theoretical Mechanics

This lecture course is based on the concepts of Newtonian (classical) mechanics and their application to engineered systems. This course introduces students to mechanical principles that are necessary to the understanding, analysis and design of mechanisms and machines. The two major parts of this course are: I. Statics and Structures; II. Kinematics and Dynamics. Topics include vector analysis, statics of rigid bodies, friction, kinematics of motion, work and energy, and dynamics of particles.

Prerequisite(s): Calculus and Differential Equation (I, II)

101014001 Mechanics of Materials

Mechanics of Materials is a branch of mechanics that studies the relationships between the external loads applied to a deformable body and the intensity of the internal forces acting within the body. The course covers the following topics: stress and strain in structural elements, mechanical properties of materials, extension, torsion and bending of members, thermal stress, static indeterminacy, stress and strain transformation. This course is one of the foundation stones for engineering science. It is designed as the standard introductory course for the mechanics of deformable bodies that every mechanical engineer must master. The course provides students the basic concepts and principles of strength of materials, gives an ability to calculate stresses and deformations of objects under external loadings, gives an ability to apply the knowledge of strength of materials on engineering applications and design problems and enables the students for all analysis and design courses in the mechanical engineering area. Laboratory experiments are required.

Prerequisite(s): Calculus and Differential Equation I, General Physics I.

101037304 Theory of Machines and Mechanisms

This course covers the basics of kinematics and dynamics of machinery. Specific topics include kinematic fundamentals; linkage synthesis; position, velocity and acceleration analysis; design and kinematic analysis of cams and gears; dynamic force analysis of linkage; static and dynamic balancing of mechanisms. Matlab is used to analyze and simulate mechanisms in the homework and project.

Prerequisite(s): Theoretical Mechanics.

101037307 Machine Design

This course is an introduction to the basic principles of modern engineering. It provides students with fundamental skills of engineering, and the ability to apply the theories of science to practice. The course focuses on the fundamentals and principles of basic mechanical elements, failure theories and design criteria, and structures of basic mechanical systems. The goal of the course is to learn how to design simple mechanical elements and systems.

Prerequisite(s): Engineering Graphics (I, II), Mechanics of Materials, Theory of Machines and Mechanisms.

101062104 Analog Electronics A

This course covers diode, bipolar junction transistor, characteristics of field-effect transistor. Common-emitter amplifier, common-collector amplifier, common-base amplifier, analysis of Q-point, ac parameters analysis (voltage gain, input resistance and output resistance). Analysis of multistage amplifier circuits and differential amplifier circuits. Frequency response of Amplifier circuits. Effects of various negative feedback on amplifiers, estimation of closed loop gain. Virtual short and virtual open in the linear circuits of operational amplifiers. Analysis of various wave generating circuits. Construction and analysis of power suppliers.

Prerequisite(s): General Physics (I, II), Fundamentals of Electric Circuit Analysis

102027101 Progress on the Discipline of Robotics

This course is a required professional course towards junior students. Scientists from different research fields are invited to give lectures about the frontier and development of the industry. The purpose of this course is to equip the students with international perspective, and familiarize the students with the latest development and the advantages of the industry.

102027102 Innovation Practice - Mechatronic Systems I

The course was developed in accordance with the characteristics of Mechatronics Engineering. It is an open, innovative practice course in combination with the features of robotics. The students are guided to know the components and the design of mechatronic systems, grasp basic knowledge of common tools to design, install, debug the mechanical and electrical system. The course lays the foundation for the follow-up courses of study and application, at the same time, cultivates the students' practical ability to solve specific problems.

102027103 Micro-electro-mechanical System Design and Fabrication

Lecture topics include: advanced material properties, microfabrication technologies, structural behaviors, sensing methods, actuation methods, energy harvesting methods, micro fluid flow and amplifiers feedback systems. Students will work in team to design a variety of types (e.g. optical MEMS, inertial sensors) of microsystems (sensors, actuators, and sensing/control systems), in accordance with a set of performance specifications (e.g. sensitivity), in a realistic microfabrication process. Modeling and simulation will be emphasized during the design process.

102027104 Signals and Systems

The concepts of signals and systems arise in a wide variety of fields, and the ideas and techniques associated with these concepts play an important role in such diverse areas of science and technology as communications, aeronautics and astronautics, circuit design. The subject of signals and systems include the concepts of signals and systems, time-domain analysis for continuous-time systems, time-domain analysis for discrete-time systems, Fourier analysis for continuous-time signals, Fourier analysis for discrete -time signals, Fourier analysis for continuous-time and discrete -time systems, the Laplace transform and analysis for continuous-time systems, the z-transform and analysis for discrete -continuous-time systems.

102027105 Innovation Practice – Mechatronic Systems II

According to the characteristics of mechanical electronic engineering in our school, a professional practice of open innovation course, electromechanical system is established combined with features of robotics. We guide students to master the electromechanical device design and understand the process of research and development, basic principle and method of use of test equipment, and then to cultivate the innovative design ability. The course enable students to have the basic capabilities of design, installation, debugging mechanical and electrical system, lay the foundation for follow-up courses of study and application. At the same time cultivate the abilities of data collection, analysis and interpretation for students.

102027106 Mechatronic Control Technology

The course introduces the design of feedback control systems, properties and the advantages of feedback systems, time-domain and frequency-domain performance measures, stability and degree of stability. It also covers root locus method and frequency-domain design. By learning this course, the students are required to master the basic concepts and principles of the control system analysis and design, to develop the problem-solving skills and feedback control thinking, to lay massive foundation for further study and future career.

102027107 Sensing and Testing Technology

This course is a foundation course of weapon system engineering, mechanical and electrical engineering. This course is to explore the static and dynamic characteristics, the basic principle, performance and usage of some typical sensors. Combining with the application of weapon system engineering, the students will master the test system analysis and design method for the specific test.

102027108 Microprocessor Systems and Assembly Language
The objective of this course is to acquaint students with the principle of microprocessors, including the structure of processors and their operational principle and to familiarize students with the assembly instructions and interface technologies. Students will be able to program the assembly language to solve some practical problems and grasp the method to control the microcomputer. The main topics of course are microprocessor structure and assembly language application. The structure of microprocessor is introduced first and on the basis of this, assembly instructions are studied (this part is emphasized). Then the programming methods are expounded respectively, including simple program, branched program, loop program and subprogram. The last part of this course is the interface technology, mainly deals with the application of parallel and serial interfaces.

102027109 Innovation Practice - Intelligent Robots I
Robotics is an advanced subject which is highly integrated and cross cutting. Through the course of learning, the students will be familiar with the basic robot technology and the development of the situation, and lay a good foundation for the future in intelligent automation technology and equipment system design and manufacturing. Through the course of learning and practice, so that students master the knowledge of robot system, including servo, motion control and system structure design techniques and basic theory.
Robot is a typical machine, electricity, drive, control, measurement, integrated device, it is not a simple combination of mechanical, electronic, but an organic combination of mechanical, electronic, drive, control, etc. Through the practical study of this course, we mobilize the students' initiative, stimulate students' creative thinking, students will learn the literature search, to sum up the analysis and decomposition of key technologies, and try to refine the scientific issues.

102027110 Introduction to Robotics
Robot is an archetypical mechatronic system that represents tremendous achievements in modern science and technology. This course is to explore the basic principles and techniques of robotics, which may involve robot structures, computer science, automatic control theory, sensor technology, bionics and artificial intelligence. It is an elective course for juniors and seniors major in mechatronics, and will lead students to profound understanding of mechatronical system.

102027111 High Frequency Electronics
This course is an introduction to high frequency (tens-hundreds MHz range) circuit design and analysis techniques, with particular emphasis on applications for sensing systems. A laboratory experience provides hands-on exposure to typical high-frequency measurement techniques. Students will develop an enhanced understanding of circuit design and analysis principles as applied to high frequency circuits, as well as gain familiarity with design techniques for both hand analysis and computer-aided design.

102027112 Computer Software Practice-Mechatronics
This course is to train the ability of the students to analyze and solve engineering problem, through learning computer software and practice related to the major of mechatronics. Students should get familiar with Matlab platform and learn to visually demonstrate the whole procedure of how to solve the problem. Through learning Alltium Designer, students should know how to develop the digital products and try to design some kinds of the products related to their research. Finally, Students should know how to logically solve the engineering problem and innovative in their research process.

102027113 Digital Image processing
This course is to explore the fundamentals of digital image processing. The basic topics of the

representation of digital image, spatial filtering, intensity transform, fourier transform, geometric transformation, color and color transform, and morphological image processing will be introduced. Other topics related to image restoration, image registration, image segmentation and object recognition will NOT be included. The basic operation of Matlab will be presented. Image processing using Matlab image processing toolbox will also be introduced.

102027115 Innovation Practice - Intelligent Robots II

Robotics is an advanced subject which is highly integrated and cross cutting. Robot technology is a set of mechanics, biology, anthropology, computer science and engineering, control theory and control engineering, electronic engineering, artificial intelligence, intelligent sensing, sociology and other disciplines, which is a strongly comprehensive new technology. Through the practicing and learning of this course, we mobilize the initiative of students, inspire the students' innovative thinking, students will learn to literature query, summary analysis and key technology of decomposition, try to refine scientific problems .We guide the students to construct and developed a robotic system, deepen the understanding of students on robotics and system, cultivate and improve the students' comprehensive use of basic theory and professional knowledge in the innovation ability.

102027116 Measurement and Virtual Instruments

The main goal of this course is for students to learn applications of programming, signal transduction, data acquisition, data analysis, signal processing used in the design of mechanical and electronical instrumentation. The software package LabVIEW has become a standard in academic and industrial environments for data acquisition, interfacing of instruments and instrumentation control. Students in this course will learn LabVIEW as a tool for the design of computer-based virtual instruments, which add software-based intelligence to sensors and basic laboratory bench devices.

Course Syllabus

101013001 Theoretical Mechanics

Lecture Hours: 64
Laboratory Hours: 0
Credits: 4
Prerequisite(s): Calculus and Differential Equation (I, II), General Physics (I, II), General Physics Lab B (I, II)

Course Description:
This lecture course is based on the concepts of Newtonian (classical) mechanics and their application to engineered systems. This course introduces students to mechanical principles that are necessary to the understanding, analysis and design of mechanisms and machines. The two major parts of this course are: I. Statics and Structures; II. Kinematics and Dynamics. Topics include vector analysis, statics of rigid bodies, friction, kinematics of motion, work and energy, and dynamics of particles.

Course Outcomes:
The objectives of this course are: to give the students the ability to analyze the motion of an object; to be able to perform a kinematic analysis as well as a kinetic analysis of an object experiencing either particle motion or planar motion.

Course Content:
Lectures and Lecture Hours:

1. General Principles 2
   - Mechanics
   - Fundamental Concepts
   - Units of Measurement
   - The International System of Units
   - Numerical Calculations
2. Force System Resultants 6
   - Moment of a Force–Scalar Formulation
   - Cross Product
   - Moment of a Force–Vector Formulation
   - Principle of Moments
   - Moment of a Force about a Specified Axis
   - Moment of a Couple
   - Simplification of a Force and Couple System
   - Further Simplification of a Force and Couple System
   - Reduction of a Simple Distributed Loading
3. Equilibrium of a Rigid Body 6
   - Conditions for Rigid-Body Equilibrium
   - Free-Body Diagrams
   - Equations of Equilibrium
   - Free-Body Diagrams
   - Equations of Equilibrium
   - Constraints and Statical Determinacy
4. Structural Analysis 6
   - Simple Trusses
   - The Method of Joints
   - Zero-Force Members
   - The Method of Sections

- Space Trusses
- Frames and Machines

4. Friction 4
   - Characteristics of Dry Friction
   - Problems Involving Dry Friction
   - Wedges
   - Frictional Forces on Screws
   - Frictional Forces on Flat Belts
   - Frictional Forces on Collar Bearings, Pivot Bearings, and Disks
   - Frictional Forces on Journal Bearings
   - Rolling Resistance
5. Virtual Work 4
   - Definition of Work
   - Principle of Virtual Work
   - Principle of Virtual Work for a System of Connected Rigid Bodies
   - Conservative Forces
   - Potential Energy
   - Potential-Energy Criterion for Equilibrium
   - Stability of Equilibrium Configuration
6. Kinematics and Kinetics of a Particle 4
   - General Curvilinear Motion
   - Curvilinear Motion： Rectangular Components
   - Curvilinear Motion： Normal and Tangential Components
   - Curvilinear Motion： Cylindrical Components
   - Newton's Laws of Motion
   - The Equation of Motion
   - Equation of Motion for a System of Particles
   - Equations of Motion： Rectangular Coordinates
   - Equations of Motion： Normal and Tangential Coordinates
   - Equations of Motion： Cylindrical Coordinates
   - Central-Force Motion and Space Mechanics
7. Planar Kinematics of a Rigid Body 6
   - Rigid Body Motion
   - Translation
   - Rotation about a Fixed Axis
   - Absolute General Plane Motion Analysis
   - Relative Motion Analysis: Velocity
   - Instantaneous Center of Zero Velocity
   - Relative Motion Analysis: Acceleration
   - Relative Motion Analysis Using Rotating Axes
8. Planar Kinetics of a Rigid Body：Force and Acceleration 6
   - Moment of Inertia
   - Planar Kinetic Equations of Motion
   - Equations of Motion：Translation
   - Equations of Motion：Rotation About a Fixed Axes
   - Equations of Motion：General Plane Motion
9. Planar Kinetics of a Rigid Body：Work and Energy 4
   - Kinetic Energy
   - The Work of a Force
   - The Work of a Couple
   - Principle of Work and Energy
   - Conservation of Energy
10. Planar Kinetics of a Rigid Body：Impulse and Momentum 4
    - Linear and Angular Momentum
    - Principle of Impulse and Momentum
    - Conservation of Momentum
    - Eccentric Impact

11. Three Dimensional Kinematics of a rigid Body 4
    - Rotation about a Fixed Point
    - The Time Derivative of a Vector Measured from Either a Fixed and Translating Rotating System
    - General Motion
    - Relative Motion Analysis Using Translating and Rotating Axes
12. Three Dimensional Kinetics of a Rigid Body 4
    - Moments and Products of Inertia
    - Angular Momentum
    - Kinetic Energy
    - Equations of Motion
    - Gyroscopic Motion
    - Torque Free Motion
13. Vibrations 4
    - Undamped Free vibration
    - Energy Methods
    - Undamped Forced Vibration
    - Viscous Damped Free Vibration
    - Viscous Damped Forced Vibration
    - Electrical Circuit Analogs

Grading:

Homework	5%
Inclass Quizzes	5%
Midterm Exams	20%
Final	70%

Text & Reference Books:

Textbook:

Russell C. Hibbeler, *Engineering Mechanics: Combined Statics & Dynamics*, 12th edition, Prentice Hall; May 3, 2009

References:

1) Bedford and Fowler. *Engineering Mechanics: Statics*, 5th edition, Prentice Hall

2) J. L. Meriam and L. G. Kraige (1997) *Engineering Mechanics: Dynamics*, 4th edition, John Wiley & Sons, New York.

3) Pytel, Andrew and Jaan Kiusalaas (1999) *Engineering Mechanics: Dynamics*, 2nd edition, Brooks/Cole Publishing, Pacific Grove, California.

4) Ginsberg, Jerry H. (1995) Advanced Engineering Dynamics, 2nd edition, Cambridge University Press, New York.

101014001 Mechanics of Materials

Lecture Hours: **48**
Laboratory Hours: **8**
Credits: **3.5**
Prerequisite(s): **General Physics I, Calculus and Differential Equation I**

Course Description:

Mechanics of Materials is a branch of mechanics that studies the relationships between the external loads applied to a deformable body and the intensity of the internal forces acting within the body. The course covers the following topics: stress and strain in structural elements, mechanical properties of materials, extension, torsion and bending of members, thermal stress, static indeterminacy, stress and strain transformation. This course is one of the foundation stones for engineering science. It is designed as the standard introductory course for the mechanics of deformable bodies that every mechanical engineer must master. The course provides students the basic concepts and principles of strength of materials, gives an ability to calculate stresses and deformations of objects under external loadings, gives an ability to apply the knowledge of strength of materials on engineering applications and design problems and enables the students for all analysis and design courses in the mechanical engineering area. Laboratory experiments are required.

Course Outcomes:

After completing this course, a student should be able to:

1. Calculate and understand the concepts of stress and strain;
2. Calculate, describe, and estimate external loadings, including axial load, shear force, bending, and torsion, and the resulting deformations and internal stresses associated with these external loadings;
3. Calculate and describe the internal stresses and deformations that result in combined loading conditions;
4. Calculate internal stresses and strains through the application of stress transformation equations and Mohr's circle;
5. Design components to meet desired needs in terms of strength and deformation.
6. Foster effective mathematical and graphical communication skills.
7. Cultivate ethical engineering decisions

Course Content:

Lectures and Lecture Hours:

1. Stress 4
   - Equilibrium of a Deformable Body
   - Stress
   - Average Normal Stress in an Axially Loaded Bar
   - Average Shear Stress
   - Allowable Stress
2. Strain 2
   - Deformation
   - Strain
3. Mechanical Properties of Materials 4
   - The Tension and Compression Test
   - The Stress-Strain Diagram
   - Stress-Strain Behavior of Ductile and Brittle Materials
   - Hooke's Law
   - Strain Energy
   - Poisson's Ratio
   - The Shear Stress-Strain Diagram

4. Axial Load 4
   - Saint-Venant's Principle
   -Elastic Deformation of Axially Loaded Member
   - Principle of Superposition
   - Statically Indeterminate Axially Loaded Member
   - The Force Method of Analysis for Axially Loaded Members
   - Thermal Stress
   - Stress Concentration
5. Torsion 4
   - Torsion Deformation of a Circular Shaft
   - The Torsion Formula
   - Power Transmission
   - Angle of Twist
   - Statically Indeterminate Torque-Loaded Members
   - Stress Concentration
6. Bending 6
   - Shear and Moment Diagrams
   - Graphical Method for Constructing Shear and Moment
   - Bending Deformation of a Straight Member
   - The Flexure Formula
   - Unsymmetric Bending
   -*Composite Beams
   - Stress Concentrations
7. Transverse Shear 6
   - Shear in Straight Members
   - The Shear Formula
   - Shear Stresses in Beams
   - Shear Flow in Built-up Members
   - Shear Flow in Thin-walled Members
8. Combined Loadings 4
   - Thin-Walled Vessels
   - State of Stress Caused by Combined Loadings
9. Stress and Strain Transformation 6
   - Plane-Stress Transformation
   - General Equations of Plane-Stress Transformation
   - Principal Stresses and Maximum In-Plane Shear Stress
   - Mohr's Circle-Plane Stress
   - Absolute Maximum Shear Stress
   - Plain Strain
   - General Equations of Plain-Strain Transformation
   - *Absolute Maximum Shear Strain
   - Strain Rosettes
   - Material-Property Relationships
   - *Theories of Failure
10. Deflections of Beams and Shafts 8
   - The Elastic Curve
   - Slope and Displacement by Integration
   - Slope and Displacement by the Moment-Area Method
   - Method of Superposition
   - Statically Indeterminate Beams and Shafts-Method ofIntegration
   - Statically Indeterminate Beams and Shafts-Moment-AreaMethod
   - Statically Indeterminate Beams and Shafts-Method ofSuperposition

<u>Laboratories and Laboratory Hours:</u>

1. Low Carbon Steel Tensile Test 2

2. Gray Cast Iron Tensile Test 2
3. Deflection Measurement for Metallic Beams 2
4. Deformation Measurement for Metallic Beam under Combined Bending and Torsion Loadings 2

Grading:

Homework	20%
Lab Report	10%
Final	70%

Text & Reference Books:

1) R. C. Hibbeler, *Mechanics of Materials*, 5th edition, 2004, ISBN 7-04-014008-X.
2) James M. Gere and Stephen P. Timoshenko, *Mechanics of Materials*, 4th edition, 1997, ISBN 0-534-95102-3.

101037304 Theory of Machines and Mechanisms

Lecture Hours: 42
Laboratory Hours: 6
Credits: 3
Prerequisite(s): Theoretical Mechanics

Course Description:
This course covers the basics of kinematics and dynamics of machinery. Specific topics include kinematic fundamentals; linkage synthesis; position, velocity and acceleration analysis; design and kinematic analysis of cams and gears; dynamic force analysis of linkage; static and dynamic balancing of mechanisms. Matlab is used to analyze and simulate mechanisms in the homework and project.

Course Outcomes:
Upon completing this course, students are able to:
1. Synthesize a mechanism using graphical and analytical methods for a given path, motion or function generation task.
2. Perform kinematic analysis to obtain position, velocity, and acceleration of a designed mechanism.
3. Perform kinetic analysis to determine dynamic forces of a designed mechanism.
4. Design and analyze cam and gear mechanisms.
5. Use Matlab to analyze and simulate mechanisms.

Course Content:
Lectures and Lecture Hours:

1.Introduction 2
- Purpose
- Kinematics and kinetics
- Mechanisms and machines
- Design process

2.Kinematics fundamentals 4
- Mechanism terminology
- Kinematic diagrams
- Kinematic inversion
- Degrees of freedom or mobility
- The four- bar mechanism
- The slider- crank mechanism

3.Position and displacement analysis 2
- Introduction
- Position analysis
- Displacement analysis
- Limiting position
- Transmission angle

4.Mechanism design 3
- Introduction
- Time ratio
- Design of slider- crank mechanisms
- Design of crank - rocker mechanisms
- Two-position synthesis
- Three-position synthesis

5.Velocity analysis 4
- Introduction

- Relative velocity method
- Instant centre method
- Graphical velocity analysis
- Analytical velocity analysis

6.Acceleration analysis 4

- Introduction
- Relative acceleration method
- Graphical acceleration analysis
- Analytical acceleration analysis

7.Cams: design and kinematic analysis 9

- Introduction
- Type of cams
- Type of followers
- Prescribed follower motion
- Follower motion schemes
- Graphical disk cam profile design
- Pressure angle
- Design limitation
- Design project: computer simulation of cam mechanisms

8.Gears: design and kinematic analysis 10

- Introduction
- Type of gears
- Spur gear terminology
- Involute tooth profile
- Standard gears
- Relationships of gears in mesh
- Spur gear kinematics
- Spur gear selection
- Helical gear kinematics
- Worm gear kinematics
- Gear trains
- Planetary gear trains

9.Dynamic force analysis 4

- Introduction
- Force analysis of the four-bar linkage
- Force analysis of the slider- crank linkage
- Balancing of rigid rotors

Laboratories and Laboratory Hours:

1. Structure analysis and kinematic diagram drawing for mechanism	2
2. Experiment on gear generating	2
3. Experiment on dynamic balance system of rigid rotor	2

Grading:

Homework	20%
Group Presentation	5%
Midterm Exams	20%
Project	20%
Final	35%

Text & Reference Books:

1) Robert L. Norton, *Design of Machinery: An Introduction to Synthesis and Analysis of Mechanisms and Machines*, 4th Edition, 2008, ISBN 978-0-07-312158-1.
2) David H. Myszka, *Machines and Mechanism: Applied Kinematic Analysis*, 4th Edition, 2012, ISBN 978-0-13-215780-3.

101037307 Machine Design

Lecture Hours: 42
Laboratory Hours: 6
Credits: 3

Prerequisite(s): Engineering Graphics (I, II), Mechanics of Materials, Theory of Machines and Mechanisms

Course Description:
This course is an introduction to the basic principles of modern engineering. It provides students with fundamental skills of engineering, and the ability to apply the theories of science to practice. The course focuses on the fundamentals and principles of basic mechanical elements, failure theories and design criteria, and structures of basic mechanical systems. The goal of the course is to learn how to design simple mechanical elements and systems.

Course Outcomes:
After completing this course, the student should be able to:
1. Understand the failure modes and design theories of typical mechanical elements.
2. Master the design criteria of basic mechanical elements.
3. Know well the typical structures of basic mechanical elements.
4. Know well the design process of typical mechanical elements.
5. Design basic mechanical elements.
6. Design simple mechanical systems.

Course Content:
Lectures and Lecture Hours:

1.Introduction to machine design 2
- Mechanical engineering design
- Basic concepts
- Design tools and resources

2.Failure theories 4
- Failures resulting from static loading
- Fatigue failures resulting from variable loading

3.Friction, lubrication and wear 4
- Basic friction theory and contact
- Lubrication
- Wear process

4.Transmission elements – Belt drive 4
- Introduction to belt drives
- Working principle of typical belt drives
- Belt drive design

5.Transmission elements – gear trains 6
- Force analysis of gearing
- Typical failure modes of gears
- Theory of surface contact fatigue strength
- Theory of tooth root bending fatigue strength
- Design of gear set and parameters determination
- Structure of gears

6.Transmission elements – Worm gears 2
- Worm-gear analysis
- Designing a Worm-gear Mesh

7.Shafts and axles 4
- Introduction
- Geometric and strength constraints

- Shaft materials
- Shaft design

8.Rolling element bearings	4
- Bearing types	
- Bearing life	
- Combined radial and thrust loading	
- Mounting and enclosure	
9.Fluid-film bearings	4
- Structure of journal bearing and materials	
- Hydrodynamic theory	
- Designing fluid-film journal bearing	
- Designing boundary-lubricated bearing	
10.Friction elements: clutches and brakes	2
- Clutches	
- Brakes	
11.Connecting elements	4
- Tread standards and definitions	
- Preload and looseness-proof	
- Force analysis	
- Bolt strength	
12.Other elements and review	2

Laboratories and Laboratory Hours:

1. Belt drive	2
2. Shaft assembly	2
3. Sliding bearing	2

Grading:

Homework	15%
Discussions and presentations	15%
Quizzes in class	10%
Lab performance	10%
Final	50%

Text & Reference Books:

1) Robert L. Norton. *Machine design, an integrated approach.* 4th Edition. ISBN: 0-13-612370-8, Upper Saddle River: Pearson Education Inc., 2010.
2) Shigley, Joseph, Charles Mischke, and Richard Budynas. *Mechanical Engineering Design.* Boston, MA: McGraw-Hill, 2003. ISBN: 9780072921939

101062104 Analog Electronics

Lecture Hours:	**54**
Laboratory	**0**
Credits:	**3.5**
Prerequisite(s):	**General Physics (I, II), Fundamentals of Electric Circuit Analysis**

Course Description:
This course covers diode, bipolar junction transistor, characteristics of field-effect transistor. Common-emitter amplifier, common-collector amplifier, common-base amplifier, analysis of Q-point, ac parameters analysis (voltage gain, input resistance and output resistance). Analysis of multistage amplifier circuits and differential amplifier circuits. Frequency response of Amplifier circuits. Effects of various negative feedback on amplifiers, estimation of closed loop gain. Virtual short and virtual open in the linear circuits of operational amplifiers. Analysis of various wave generating circuits. Construction and analysis of power suppliers.

Course Outcomes:
After completing this course, a student should be able to master the fundamental theory, concepts, analysis methods and techniques of the analog electronics. Details are listed in the following:

1. Fundamental concepts, characteristics and parameters of semiconductor devices.
2. Theory and analysis of fundamental amplifier circuits.
3. Characteristics and analysis of feedback circuits.
4. Analysis and applications of linear and nonlinear operational amplifier circuits.
5. Analysis and design of wave generation circuits and power suppliers.
6. Simulation methods of amplifier circuits using Multisim2001.

Course Content:
Lectures and Lecture Hours:

1.	Semiconductor Materials and Diodes - Semiconductor Materials - Semiconductor Diodes	2
2.	Bipolar Junction Transistor (BJT) and Basic BJT Amplifiers - Bipolar Junction Transistor - Fundamental Theory and Performance Evaluation of BJT Amplifiers - Graphical Methods for BJT Amplifier Analysis - Small-signal Equivalent Circuits for BJT Amplifier Analysis - Other Basic BJT Amplifiers - Compound Amplifiers	8
3.	Field-Effect Transistor (FET) and Basic FET Amplifiers - Field-Effect Transistor - Basic FET Amplifiers	4
4.	Multistage Amplifiers and Operational Amplifiers - Connection and Analysis of Multistage Amplifiers - Differential Amplifier Circuits - Operational Amplifier Circuits	6
5.	Power Amplifiers	4

- Introduction – Definitions and Amplifier Types
- Class-A Power Amplifiers
- Push-Pull Complementary Power Amplifiers
- Power Amplifier Circuits
- Power Transistor Heat Sinking

6. Amplifier Frequency Response 3
- Introduction
- Frequency Response of RC Circuits
- High-Frequency Equivalent Models of BJT and FET
- Frequency Response of Single Transistor Amplifiers
- Frequency Response of Multistage Amplifiers
- Time-domain Response

7. Feedback in Amplifier Circuits 6
- Concepts and Types of Feedback
- Block Diagram of Feedback Amplifiers
- Effects of Negative Feedback on Amplifiers
- Analysis of Negative Feedback Amplifiers
- Right Connection of Feedback in Amplifier Circuits
- Oscillation in Negative Feedback Amplifiers and Its Removal Methods

8. Linear Applications of Operational Amplifiers 6
- Introduction
- Basic Arithmetic Circuits
- Logarithm and Exponent Circuits
- Multiplication and Division Circuits
- Effects of Real Operational Amplifiers on Arithmetic Circuits
- Active Filter Circuits
- Switched Capacitor Filter Circuits

9. Oscillators and Nonlinear Applications of Operational Amplifiers 8
- Sine Wave Oscillator Circuit
- Voltage Comparator
- Non Sine Wave Generating Circuit

10. DC Power Supply 5
- Rectification Circuits
- Filter Circuits
- Regulator Circuits
- Integrated Regulator and Its Applications

11. EDA Technology and Programmable Analog Devices 2

Grading:

Homework	10%
Inclass Quizzes	10%
Project	10%
Final	70%

Text & Reference Book:

Donald A. Neamen, *Microelectronics-Circuits Analysis and Design*, 3rd edition, 2007, McGraw Hill Press and Tsinghua University Press.

102027101 Progress on the Discipline of Robotics

Lecture Hours: 16
Laboratory Hours:0
Credits: 1

Prerequisite(s): Mechanical Design, Digital Electronics, Analog Electronics

Course Description:
This course is a required professional course towards junior students. Scientists from different research fields are invited to give lectures about the frontier and development of the industry. The purpose of this course is to equip the students with international perspective, and familiarize the students with the latest development and the advantages of the industry.

Course Outcomes:
After completing this course, a student should be able to:
1. Have international perspective of robotics
2. Be familiar with the latest developments of mechanical engineering

Course Content:
Lectures and Lecture Hours:

1.	Introduction to legged robots	2
2.	Introduction to micro-nano robots	2
3.	Introduction to medical robots	2
4.	Introduction to space robots	2
5.	Introduction to rehabilitation robots	2
6.	Introduction to rescue robots	2
7.	Introduction to human-robot interface	2
8.	Introduction to unmanned systems	2

Grading:

Classroom performance	40%
Report	60%

Text & Reference Book:
1) Bruno Siciliano, Oussama Khatib. Handbook of Robotics, Springer, 2008
2) Ahmed A. Shabana. Dynamics of Multibody Systems, Cambridge, 2005
3) Toshio Fukuda, Tomohide Niimi and Gero Obinata, Micro-Nano Mechatronics, Intech, 2013.
4) Toshio Fukuda, Yasuhisa Hasegawa, Kosuke Sekiyama and Tadayoshi Aoyama, Multi-Locomotion Robotic Systems, Springer, 2012.

102027102 Innovation Practice – Mechatronic systems I

Lecture Hours: 10
Laboratory Hours:54
Credits: 2

Prerequisite(s): a) Engineering drawing b) programming language C

Course Description:
The course was developed in accordance with the characteristics of Mechatronics Engineering. It is an open, innovative practice course in combination with the features of robotics. The students are guided to know the components and the design of mechatronic systems, grasp basic knowledge of common tools to design, install, debug the mechanical and electrical system. The course lays the foundation for the follow-up courses of study and application, at the same time, cultivates the students' practical ability to solve specific problems.

Course Outcomes:
After completing this course, a student should be able to:
1. Understand the components of electromechanical system and its design methods.
2. Understand the commonly used components of electromechanical system.
3. Understand the mechanical design software, electric driver and sensors, as well as the simple performance analysis and improvement of electromechanical system.
4. Understand the motor driver control technology and can use the single chip to control multiple motors.
5. Understand the principle of the angle sensors, displacement sensors and visual sensors.

Course Content:
Lectures and Lecture Hours:

1. Introduction 2
    - 1.1 Present situation and trend of electromechanical system technology development
    - 1.2 Introduction the commonly used components of electromechanical system
2. Electromechanical system 6
    - 2.1 Commonly used software for the electromechanical system
    - 2.2 Mechanical parts design and processing for the electromechanical system
    - 2.3 Electromechanical control technology for the electromechanical system
    - 2.4 Motor driver control technology for the electromechanical system
    - 2.5 Peripheral sensing detection for the electromechanical system
3. Data reorganization and defense 2
    - 3.1 Data collection, and preparation of documents
    - 3.2 Electromechanical system display
    - 3.3 Defence

Laboratories and Laboratory Hours: 54
Students are divided into several teams. Each team selects a very simple electromechanical system to design and build. Each team needs to give a presentation weekly. The team members make turns inside. Finally, each team should complete its own electromechanical system and show it in the final defence. The procedure is guided by the teacher.

Grading:

Presentation	20%
Physical display	70%
Performance in class	10%

Text & Reference Book: N/A

102027103 Micro-electro-mechanical System Design and Fabrication

Lecture Hours: 24
Laboratory Hours: 8
Credits: 2

Prerequisite(s):
1. Pass the examination of College Physics
2.Complete course of Digital Fundamentals of Electronic Technology and Analog Fundamentals of Electronic Technology

Course Description:
Lecture topics include: advanced material properties, microfabrication technologies, structural behaviors, sensing methods, actuation methods, energy harvesting methods, micro fluid flow and amplifiers feedback systems. Students will work in team to design a variety of types (e.g. optical MEMS, inertial sensors) of microsystems (sensors, actuators, and sensing/control systems), in accordance with a set of performance specifications (e.g. sensitivity), in a realistic microfabrication process. Modeling and simulation will be emphasized during the design process.

Course Outcomes:
After completing this course, a student should be able to:
1. Understand the basic knowledge of micro-electro-mechanical system.
2. Design, Molding and simulating the micro system projects, such as sensors, actuators and energy harvesters.
3. Mastering micro-system fabrication technology, such as photolithography, etching, deposition.

Course Content:
Lectures and Lecture Hours:

1.Introduction	2
- Definitions of micro-electro-mechanical system technology	
- History of MEMS technology	
- Typical applications of MEMS technology	
- Development trend of MEMS technology	
2.Principles of MEMS system	4
- Capacitive effect	
- Piezoresistive effect	
- Piezoelectric effect	
- Electrostatic effect	
- Pyroelectric effect	
- Photoelectric effect	
3.Typical MEMS sensors and applications	4
- Force MEMS sensor	
- Vibration MEMS sensor	
- Chemical MEMS Sensor	
- Bio MEMS sensor	
- Optical MEMS sensor	
4.Typical MEMS actuators and applications	4
- Electrostatic MEMS actuators	
- Piezoelectric MEMS actuators	
- Thermal MEMS actuators	
5.MEMS system design, molding and simulation	4
- Principles of MEMS system design	
- Approaches for MEMS system design	
- Approaches for molding	

- Approaches for simulation

6.Concept of MEMS system fabrication 2

- Characteristics of MEMS system fabrication
- Fabrication capability of MEMS and CMOS
- Procedure of Silicon-based MEMS system fabrication
- Procedure of polymer-based MEMS system fabrication

7.Silicon-based MEMS fabrication 6

- Photolithography process
- Etching process
- Deposition process

8.Non Silicon-based MEMS fabrication and package 2

- LIGA techniques
- Special machining techniques
- Package techniques

Laboratories and Laboratory Hours:

1. Typical MEMS sensors and actuators design, molding and simulation 6
2. Demonstrating experiments of vibration sensors 2

Grading:

1. Final examination 60%
2. Regular grades 40%

1) Attendance of class and laboratory 25%
2) Experiment report 15%

3. 5 points deduction if absence; 3 points deduction if not handing in experiment report

Text & Reference Book:

1) Wang J K, Microsystem design and fabrication [M]. Beijing Tsinghua Press. 2015.
2) Chang L. Microsystem Foundation [M]. Beijing mechanical engineering Press. 2013.

102027104 Signals and Systems

LectureHours: 48
Laboratory Hours:8
Credits: 3.5
Prerequisite(s): Calculus and Differential Equation，Circuit Analysis，Fundmentals of Analog Electronics，Fundmentals of Digital Electronics

Course Description:
The concepts of signals and systems arise in a wide variety of fields, and the ideas and techniques associated with these concepts play an important role in such diverse areas of science and technology as communications, aeronautics and astronautics, circuit design. The subject of signals and systems include the concepts of signals and systems, time-domain analysis for continuous-time systems, time-domain analysis for discrete-time systems, Fourier analysis for continuous-time signals, Fourier analysis for discrete -time signals, Fourier analysis for continuous-time and discrete -time systems, the Laplace transform and analysis for continuous-time systems, the z-transform and analysis for discrete -continuous-time systems.

Course Outcomes:
The objectives of this course are: to make the students understand the concept of signals and system, to give the students the ability to process signals and analyze the function of the systems, learn to do the Fourier Transformation, Laplace Transformation and z Transformation.

Course Content:
Lectures and Lecture Hours:
1. Basic concepts of signals and systems 3
   - The concept of the signal and the waveform transformation, the basic continuous time signal and the discrete time signal
   - The concept of the system, system interconnection, characteristics and classification of systems
2. Time domain analysis of continuous time systems 6
   - The differential equation description of the system and its solution, zero input, zero state, unit impulse response
   - Solve the zero state response by using the convolution integral, the nature of the convolution integral and all its solution
   - Characterization of the unit impulse response and singular function of the system
3. Time domain analysis of discrete time systems 4
   - The description and solution of the differential equation of the system, zero input, zero state, unit impulse response
   - Solve the zero state response by using the convolution integral, the nature of the convolution integral and all its solution
   - Representing System by using unit sampling response, discrete time system simulation, and the deconvolution
4. The Continuous-Time Fourier Transform-- spectrum analysis of continuous time 5
   - Orthogonal function, continuous time Fourier series and its properties
   - Waveform symmetry and Fourier coefficient, spectrum of periodic signals and the effective bandwidth
   - The relationship between continuous time Fourier transform, Fourier transform and Fourier series
   - The properties and applications of Fourier transform, the power spectrum and energy spectrum of the signal
   - Brief introduction to the short time Fourier transform (STFT) and time domain analysis
5. Spectrum analysis of discrete time signal 6

- Discrete time processing of continuous time signals, sampling theorem
- Discrete time Fourier series (DFS) and its properties
- Discrete time Fourier transform (DTFT) and its properties

6. Frequency domain analysis of continuous time and discrete time systems 6
   - Frequency response of continuous time system, Fourier analysis method, polar coordinate representation of frequency response
   - The non-distortion transmission condition of system, ideal filter, cascade, parallel structure
   - Frequency domain analysis of discrete time systems, the relationship between DFS and DTFT
7. Complex frequency domain analysis of continuous time system 6
   - Laplasse transform and its properties, Laplace pairs, Laplasse inverse transform
   - Single side Laplace transform and its properties, the complex frequency domain analysis method
   - The relationship between system function, Z transform and Laplace transform
8. Z transform and Z domain analysis of discrete time system 6
   - Z transform and its properties, Common Z transform pair, Z inverse transform
   - Unilateral Z transform and its properties, Complex frequency domain analysis method
   - System function, Relationship between Z transform and Laplace transform
9. Analysis of state variables of continuous time and discrete time systems 3
   - State and state variables, Method for establishing state equation

General review of the whole class (3 lecture hours)
Simulation Experiment (8 lecture hours)

Experimental items can be selected from the following:

(1) Time domain analysis of linear systems (2 lecture hours)
(2) Frequency domain analysis of continuous signals (2 lecture hours)
(3) Frequency domain analysis of continuous system (2 lecture hours)
(4) Z domain analysis of discrete systems (2 lecture hours)
(5) Fourier series representation of periodic signals (2 lecture hours)

<u>Grading:</u>

Homework	10%
Inclass Quizzes	10%
Experiment Report	10%
Final	70%

<u>Text & Reference Books: Textbook:</u>

William M. Siebert, *Circuits, Signals, and Systems*, 1st edition, MIT Press; September 24, 1985

References:

1) Alan V. Oppenheim. *Signals and Systems*, 2nd edition, PrenticeHall
2) John I. Molinder (2006) *Fundamentals of Signals and Systems*, 1st edition, Cambridge University Press.
3) Rawat, Tarun Kumar (2010) *Signals and Systems*, 1st edition, Oxford University Press,USA.
4) S.S. Haykin (2003) *Signals and Systems*, 2nd edition, John Wiley & Sons.

102027105 Innovation Practice - Mechatronic systems II

Lecture Hours: 10
Laboratory Hours: 54
Credits: 2
Prerequisite(s): a) Engineering drawing b) programming language C

Course Description:
According to the characteristics of mechanical electronic engineering in our school, a professional practice of open innovation course, electromechanical system is established combined with features of robotics. We guide students to master the electromechanical device design and understand the process of research and development, basic principle and method of use of test equipment, and then to cultivate the innovative design ability. The course enable students to have the basic capabilities of design, installation, debugging mechanical and electrical system, lay the foundation for follow-up courses of study and application. At the same time cultivate the abilities of data collection, analysis and interpretation for students.

Course Outcomes:
After completing this course, a student should be able to:
1. Understand the components of electromechanical system and its design methods.
2. Understand the thinking mode affecting the performance of electromechanical system.
3. Understand the working mechanism and design method, electric drive and control system, as well as the performance analysis and improvement of electromechanical system.
4. Briefly analyze the design of the system according to the requirements of electromechanical system, the selection and design of core technology parameters.
5. Propose the scheme of corresponding electromechanical system selection according to various functional requirements, analyze the factors affecting the performance of the system, propose different electromechanical system design and analysis of the mode of thinking.

Course Content:
Lectures and Lecture Hours:
1.Introduction 2
- 1.1 Present situation and trend of electromechanical system technology development
- 1.2 Introduction to electromechanical system classification and function

2.Electromechanical system 6
- 2.1 The selection of the electromechanical system
- 2.2 Selection and design of the core functional components of the electromechanical system
- 2.3 Processing and purchasing of core functional components of electromechanical system
- 2.4 Performance testing and integration of the core functional components of the electromechanical system
- 2.5 Electromechanical system integration and testing

3.Data reorganization and defense 2
- 3.1 Data collection, and preparation of documents
- 3.2 Electromechanical system display
- 3.3 Defence

Laboratories and Laboratory Hours: 54
Students are divided into several teams. Each team selects a complex electromechanical system to design and build. Each team needs to give a presentation weekly. The team members make turns inside. Finally, each team should complete its own electromechanical system and show it in the final defence. The procedure is guided by the teacher.

Grading:

Presentation	20%
Physical display	70%

Performance in class 10%

Text & Reference Book:

1) Chen Yong [et al.] Electromechanical control technology and application Beijing: People's Posts and Telecommunications Press, 2015

2) Zhang Jianmin. Mechatronics System Design, Fourth Edition. Beijing: Higher Education Press, 2014

102027106 Mechatronic Control Technology

Lecture Hours: 48
Laboratory Hours: 8
Credits: 3
Term(If necessary):5
Prerequisite(s): Linear Algebra, College Physics, Matlab software application

Course Description:
The course introduces the design of feedback control systems, properties and the advantages of feedback systems, time-domain and frequency-domain performance measures, stability and degree of stability. It also covers root locus method and frequency-domain design. By learning this course, the students are required to master the basic concepts and principles of the control system analysis and design, to develop the problem-solving skills and feedback control thinking, to lay massive foundation for further study and future career.

Course Outcomes:
After learning this course, the students will be able to obtain a basic understanding of feedback control systems theory, the ability to perform analysis and design of linear feedback control systems, using both time and frequency domain techniques and hands on experience analyzing and designing control system.

Course Content:
Lectures and Lecture Hours: 40
The course includes six chapters which consist of Introduction to Control Systems, Mathematic Models of Control Systems, Time-Domain Analysis of Control Systems, Root Locus Method, Frequency Response Method and Compensation of Control Systems. The break-down details in each chapter make step by step understanding.

Grading:

Final exam	70%
Homework	30%

Text & Reference Book:
Richard C.Dorf,Robert H.Bishop .Modern Control Systems [M].Beijing: Higher Education Press，2001.

102027107 Sensing and Testing Technology

Lecture Hours: 40
Laboratory Hours: 8
Credits: 3
Term(If necessary):6
Prerequisite(s): Electronic Technology; Engineering Mechanics; College Physics

Course Description:
This course is a foundation course of weapon system engineering, mechanical and electrical engineering. This course is to explore the static and dynamic characteristics, the basic principle, performance and usage of some typical sensors. Combining with the application of weapon system engineering, the students will master the test system analysis and design method for the specific test.

Course Outcomes:
After completing this course, a student should be able to:
1. Descript some engineering signal in time domain and frequency domain and mast the working principle, characteristics ,signal conditioning circuit and application of all kinds of sensors;
2. Use the knowledge about physics, mechanics of materials, electronics to analyze the basic principle of the sensor; use the knowledge about system dynamics, signal and system to analyze the test system or the sensor's static and dynamic characteristics.
3. Solve the testing problems of weapon system and improve the existing weapon testing system and interpret the test data or test results to evaluate the related performance of weapon system.
4. Carry out research on the special problems about sensing and testing in the process of weapon system design.

Course Content:
Lectures and Lecture Hours: 48
Signals and its description; Basic characteristics of the testing device; Measurement error; Commonly used sensor; Signal processing, recording and processing; Displacement measurement; Velocity and acceleration measurement; Force, torque, pressure measurement; Vibration measurement; Temperature and flow measurement.
Laboratories and Laboratory Hours: 8
The class also includes laboratory experience. Laboratory experiments are dynamic characteristic of test system and sensor calibration.

Grading:

Prerequisite quiz	10%
Homework	10%
Final	80%

Text & Reference Book:
1) Wang Huaxiang, Zhang Shuying. The principle and application of sensor (Third Edition) [M]. Tianjin: Tianjin University Press, 2002
2) Zhou Shengguo, Li Shiyi. Test technology for Mechanical Engineering [M]. Beijing: Beijing Institute of Technology Press, 2005

102027108 Microprocessor Systems and Assembly Language

Lecture Hours: 32
Laboratory Hours: 16
Credits: 3
Prerequisite(s): **Computer Technology and Programming**
Fundmentals of Analog Electronics, Fundmentals of Digital Electronics

Course Description:
The objective of this course is to acquaint students with the principle of microprocessors, including the structure of processors and their operational principle and to familiarize students with the assembly instructions and interface technologies. Students will be able to program the assembly language to solve some practical problems and grasp the method to control the microcomputer. The main topics of course are microprocessor structure and assembly language application. The structure of microprocessor is introduced first and on the basis of this, assembly instructions are studied (this part is emphasized). Then the programming methods are expounded respectively, including simple program, branched program, loop program and subprogram. The last part of this course is the interface technology, mainly deals with the application of parallel and serial interfaces.

Course Outcomes:
1. Knowing and understanding the numeration system, numerical code and other basic knowledge, understand the basic principle of computer, learning the hardware structure and composition of computer, understand the function of the executing components of microprocessor and each bus interface unit and their mutual communication process, understanding external electrical interface and the communication method.
2. Knowing and understanding the assembly language and corresponding programming method, systematically learn the assembly instructions including the special usage and the programming details, complete the assembly language experiments, understand the assembly language programming thought.
3. Master the write, compile, link, operation method of assembly language, able to program using the assembly language on microprocessor, able to design the external circuits and complete the corresponding driver program according to certain application.
4. On the basis of learning the hardware structure of the microprocessor and assembly language, forming the ability to develop the software and hardware of the microprocessor as well as other relating processors.

Course Content:
Lectures and Lecture Hours:
1.Basic knowledge of Microcomputer 2
- Number and number system
- Operation of binary number and its addition circuit

2.The basic circuit of a microcomputer 1
- Tristate output circuit
- Bus architecture
- Memorizer

3.The operation principle of a microcomputer 4
- Overview and basic components of computer systems
- Simplify the operation principle of the computer

4.Microprocessor 6
- Description
- Structure of 8086/8088 CPU
- Pin signal and operation mode of 8086/8088 CPU

- Main operation function of 8086/8088 CPU

5.Instruction system of a microcomputer	4
- Assembly language and instruction format of the 86 series	
- CPU addressing mode of the 86 series	
-Instruction system	
6.Assembly language and assembler	4
- Dummy order	
- Macroinstruction	
- System function call	
- Assembler function and process	
7.Program design of Microcomputer	5
- Program design of Microcomputer	
- Simple programming	
- Cycle programming	
- Branch programming	
- Subroutine programming	
- Assembly language programming	
8.Input / output interface	6
- Microcomputer input / output interface	
- Parallel communication and parallel interface	
- Programmable parallel communication interface chip 8255A	
- Serial communication and serial interface	
- Programmable serial communication interface chip 8251A	

Grading:

Inclass Quizzes	10%
Experimental Course	20%
Experimental Test	10%
Final	60%

Text & Reference Book:

1) Z. Xuejian, Z. Bing, Principle and Application of Microcomputer, 4th ed., 2013, ISBN 978-7-302-28328-7
2) Kip R. Irvine,Assembly Language for x86 Processors, (6th Edition),2011, ISBN：9787302260301\

102027109 Innovation Practice-Intelligent Robots I

Lecture Hours: **20**
Laboratory Hours: **44**
Credits: **2**
Prerequisite(s): Basis of circuit analysis, Mechanical engineering foundation I and A, Computer control and servo system, Introduction to Robotics

Course Description:
Robotics is an advanced subject which is highly integrated and cross cutting. Through the course of learning, the students will be familiar with the basic robot technology and the development of the situation, and lay a good foundation for the future in intelligent automation technology and equipment system design and manufacturing. Through the course of learning and practice, so that students master the knowledge of robot system, including servo, motion control and system structure design techniques and basic theory.
Robot is a typical machine, electricity, drive, control, measurement, integrated device, it is not a simple combination of mechanical, electronic, but an organic combination of mechanical, electronic, drive, control, etc. Through the practical study of this course, we mobilize the students' initiative, stimulate students' creative thinking, students will learn the literature search, to sum up the analysis and decomposition of key technologies, and try to refine the scientific issues.

Course Outcomes:
After completing this course, a student should be able to:
1. Understand the components of the robot and its functional principles and design methods.
2. Understand the working principle of the robot's mechanism, electric drive, control system ,etc, and the relationship between each other
3. Understand the design methods of mechanism, electric drive and control system, as well as the performance analysis and improvement of robot mechanism, electric drive and control system.
4. Briefly analyse the design of the system according to the requirements of robot system, the selection and design of core technology parameters.
5. Propose the scheme of corresponding robot system selection according to various functional requirements, Analyse the factors affecting the performance of the robot system, develop different robot system design and analysis of the mode of thinking.

Course Content:
Lectures and Lecture Hours:
1.Introduction 4
    1.1 Present situation and trend of robot technology development
    1.2 Core technologies involved in Robotics
    1.3 Robot mechanism, electric drive, and control system
2.Robot mechanism design, process and test method 4
    2.1 The position of mechanism in robot technology
    2.2 Types and design points of robot mechanism
    2.3 Design of robot mechanism
    2.4 Machining, assembling and testing of robot mechanism
3.Design technology of robot electric drive 6
    3.1 Position of electric drive in robot technology
    3.2 Types and design points of robot drive
    3.3 Design of robot diver
    3.4 Machining, assembling and testing of robot driver
4.Function and design method of robot control system 4
    4.1 The position of control system in robot technology

4.2 Types and design points of robot control system
4.3 Design of robot control system
- 4.4 Integration and evaluation of robot control system

5.Data reorganization and defense 2

5.1 Data collection, and preparation of documents and PPT
5.2 Display of robot mechanism, electric drive and control system
5.3 Defence

Laboratories and Laboratory Hours: 44

Students are divided into several teams. Each team selects one kind of robots to design and build. The robot should have moving parts, which are driven by motors. Each team needs to give a presentation weekly. The team members make turns inside. Finally, each team should complete its own electromechanical system and show it in the final defence. The procedure is guided by the teacher.

Grading:

Presentation	15%
Simulation and physical display	50%
Defense	25%
Performance in class	10%

Text & Reference Book:

1) John J Craig;Translated by Chao Yun et al. Introduction to robotics. Third edition, Mechanical Industry Press
2) J.M.Selig;Translated by Xiangdong Yang. The geometric basis of robotics. Tsinghua University press, 2008
3) Zixing Cai.Robotics Second Edition, Tsinghua University press, 2009
4) Aimin Zhang, editor in chief. Automatic control principle. Tsinghua University press 2006
5) Ping Qian, editor in chief. Servo system. Mechanical Industry Press 2005
6) Edited by Jinkun Liu. MATLAB design and Simulation of the robot control system. Tsinghua University press, 2008

102027110 Introduction to Robotics

Lecture Hours: **32**
Laboratory Hours: **0**
Credits: **2**
Prerequisites: **Mechanical Design, CAD, Automatic Control Theory**

Course Description:
Robot is an archetypical mechatronic system that represents tremendous achievements in modern science and technology. This course is to explore the basic principles and techniques of robotics, which may involve robot structures, computer science, automatic control theory, sensor technology, bionics and artificial intelligence. It is an elective course for juniors and seniors major in mechatronics, and will lead students to profound understanding of mechatronical system.

Course Outcomes:
After completing this course, a student should be able to:
1. Understand mechanisms of serial and parallel robots, manipulators and mobile robots.
2. Master mathematical description methods of rigid body kinematics and transformation of coordinates.
3. Establish kinematical equations of manipulator and solve inverse kinematical equations via D-H parameter description method and joint kinematics.
4. Establish and solve dynamical equations of manipulator using Euler-Newton iterative equation, Lagrangian mechanism and Kane's method.

Course Content:
Lectures and Lecture Hours:

1.Overview of robot mechanisms	2
- Background	
- The mechanics and control of mechanical manipulators	
2.Foundation of mathematics	10
- Linear transformation	
- Rotation of rigid body	
- Transformation of coordinates and homogeneous coordinates	
3.Kinematics of simple manipulators	10
- D-H description method and joint kinematics	
- Kinematics of 6R manipulator	
- Decoupling of inverse kinematics of manipulators	
- Velocity, accelerated velocity and statics analysis of manipulators	
- Performance index of kinetostatics	
4.Trajectory planning: pick-and-place operation	6
- General considerations in path description and generation	
- Joint-space schemes	
- Cartesian-space schemes	
- Geometric problems with cartesian paths	
5.Dynamics of series manipulators	4
- Inverse dynamics and forward dynamics	
- Dynamical equations and its dynamical performance of manipulator	
- Euler-Lagrange equations of serial manipulator	

Grading:

Homework	30%
Final Exam	70%

References:

1) Zixing Cai. Robotics（2nd version）[M]. Beijing：Tsinghua University Press，2009.
2) Craig, J. J. Introduction to Robotics: Mechanics and Control, 3rd Edition[M], New Jersey: Prentice Hall, 2005.
3) Siciliano, B. and Khatib, O. Springer Handbook of Robotics[M], Berlin: Springer-Verlag, 2008.

102027111 High Frequency Electronics

Lecture Hours: 48
Laboratory Hours: 12
Credits: 3
Prerequisite(s): Fundamental Circuit Analysis, Fundamentals of Analog Electronics

Course Description:
This course is an introduction to high frequency (tens-hundreds MHz range) circuit design and analysis techniques, with particular emphasis on applications for sensing systems. A laboratory experience provides hands-on exposure to typical high-frequency measurement techniques. Students will develop an enhanced understanding of circuit design and analysis principles as applied to high frequency circuits, as well as gain familiarity with design techniques for both hand analysis and computer-aided design.

Course Outcomes:
Designing electronic circuits in the tens and hundreds of MHz range can be a challenge because the presence of parasitics poses a lot of problems in the physical circuits. The objectives of this course is for students to assimilate knowledge of the high frequency characteristics with a focus on sensing systems and will touch upon some basics for the GHz range design.

Course Content:
Lectures and Lecture Hours:

1. General Communication Design 2
2. Resonant Circuits And Filter Characteristics 4
   A. Series
   B. Parallel
   C. Single Tuned
   D. Double Tuned
   E. Crystal And Ceramic And Other Similar Techniques
   F. General If Filter Design Techniques
3. Small Signal High Frequency Amplifiers 6
   A. Models Of Solid State And Tube Devices
   B. Network Parameters
   C. Power Gain
   D. Stability And Alignability
   E. Overall Design Of If And/Or Filter Stages
4. Front End Receiver Design 4
   A. Noise Considerations
   B. Gain And Transducer Stability
   C. Input/Output Parameters
5. Am/Fm General Design 4
   A. Receiving Systems
   B. Receiver Evaluations And Measurements
   C. Front End Design
   D. General Design Of Systems
6. Mixers 4
   A. Basic Mixer Theory And Spectral Analysis
   B. Types Of Mixers
   C. Practical Mixer Design
7. Oscillators And Frequency Synthesizers 4
   A. Oscillator Concepts
   B. Types Of Oscillators
   C. Noise In Oscillators

D. Methods Of Frequency Synthesis
E. Phase Lock Loops

8. Detector Design 4
A. Am/Fm Detector Design
B. Basic Circuit Designs
C. Stereo And Multiple Channel Examples

Laboratories and Laboratory Hours:

Oscillator design	3
Small-Signal amplifier design	3
Amplitude modulation/demodulation design	3
Mixer design	3

Grading:

In class Quizzes	30%
Final exam	70%

Text & Reference Book:

Reinold Ludwig et al. RF Circuit Desig Theory and Applications; Second Edition

102027112 Computer Software Practice-Mechatronics

Lecture Hours: **16**
Laboratory Hours: **16**
Credits: **2**
Prerequisite(s): Calculus, Linear Algebra, Fundamentals of Analog Electronics, Fundamentals of Digital Electronics

Course Description:

This course is to train the ability of the students to analyze and solve engineering problem, through learning computer software and practice related to the major of mechatronics. Students should get familiar with Matlab platform and learn to visually demonstrate the whole procedure of how to solve the problem. Through learning Alltium Designer, students should know how to develop the digital products and try to design some kinds of the products related to their research. Finally, Students should know how to logically solve the engineering problem and innovative in their research process.

Course Outcomes:

After completing this course, a student should be able to:

1. Get familiar with the basic calculation in Matlab and also the matrix manipulation, graphical demonstration.
2. Get familiar with the simulation and analysis technique in the Matlab platform.
3. Know the concept about automatic design of PCB and its working principle.
4. Learn how to achieve device packaging, schematic diagram design and wiring in the PCB.

Course Content:

Lectures and Lecture Hours:

1.Basic manipulation in Matlab	2
- Introduction	
- Basic manipulation	
2.Numerical calculation	2
- Matrix manipulation	
- Basic mathematical function	
- Operation of polynomials of several variables	
3.Design of the program in Matlab	2
- Script and function in M-files	
- Input and output of data	
- Control structure of program	
4.Drawing in Matlab	2
- Ezplot	
- 3D plotting	
5.Application of Matlab	2
- Numerical solution of linear polynomial	
- Data fitting	
- Extreme value	
6.Basic manipulation in Altium Designer	2
- Introduction	
- Basic manipulation	
7.Schematic diagram of electric circuit	2
- Basic concept	
- Setting of user profile	
- Electrical connection	
8.Design of printed circuit board	2
- PCB design procedures	

- Components layout and adjustment
- Automated wiring and manual wiring

Laboratories and Laboratory Hours:

1.Computer experiment of Matlab	8
- Basic manipulation and matrix manipulation	
- Programming	
- Drawing	
2.Computer experiment of Altium Designer	8
- Electric connection in the schematic diagram	
- Layout of components and automated wiring in PCB	
- Manual adjustment and wiring	

Grading:

Inclass Quizzes	40%
Final exam	60%

Text & Reference Book:

1) Brian D. Hahn， Dan Valentine. Essential MATLAB for Engineers and Scientists；5th edition 1988

102027113 Digital Image Processing

Lecture Hours: 48
Laboratory Hours:0
Credits: 3
Prerequisite(s): Linear Algebra, Matlab, c programming language

Course Description:
This course is to explore the fundamentals of digital image processing. The basic topics of the representation of digital image, spatial filtering, intensity transform, fourier transform, geometric transformation, color and color transform, and morphological image processing will be introduced. Other topics related to image restoration, image registration, image segmentation and object recognition will NOT be included. The basic operation of Matlab will be presented. Image processing using Matlab image processing toolbox will also be introduced.

Course Outcomes:
After completing this course, a student should be able to:
1. Have a concrete knowledge base on important image concepts including spatial filtering, intensity, color space and transformation, fourier transform of images, geometric transformation, morphological image processing, representation of images.
2. Have a Basic Matlab programming skills.
3. Use Matlab to do image operations including morphological image processing, color space transformation and intensity transformation, geometric transformation, fourier transfom.

Course Content:
Lectures and Lecture Hours:

1. Matlab Introductio		6
1.1 matrices and arrays	2	
1.2 simple calculations and graphs	2	
1.3 programming in Matlab	2	
2. Image Representation		6
2.1 Digital Image Representation	2	
2.2 read, write and plot images	2	
2.3 image types	2	
3. Intensity Transform and Spatial Filtering		6
3.1 Intensity Transformation	2	
3.2 Histogram Processing	2	
3.3 Spatial Filtering	2	
4. Filtering in Frequency Doman		6
4.1 2-D Discrete Fourier Transform	2	
4.2 Filtering in the Frequency Domain	2	
4.3 Frequency Domain filters	2	
5. Geometric Transformation		6
5.1 Transforming Points	2	
5.2 Affine and Projective Transformations	2	
5.3 Image Coordinate Systems and Image Interpolation	2	
6. Color Image Processing		6
6.1 Color Image Representation	2	
6.2 Converting between Color Space	2	
6.3 Color Image Transformations	2	
7. Morphological Image Processing		6
7.1 Dilation and Erosion	2	
7.2 Opening and Closing	2	
7.3 Labeling Connected Components	2	

8. Matlab Image processing ToolBox 6

Laboratories and Laboratory Hours: 0 hours

Grading:

Attendance	10%
Excercises	20%
Exam	80%

Text & Reference Book:

1) Gonzalez, Woods and Eddins, Digital Image Processing Using Matlab 2nd Ed, 2009.
2) Gonzalez and Woods, Digital Image Processing, 3rd Ed, 2008.

102027115 Innovation Practice - Intelligent Robots II

Lecture Hours: 10
Laboratory Hours:54
Credits: 2
Prerequisite(s): a) Robotics b) Computer control and servo system c) Microcomputer principle and interface technology

Course Description:
Robotics is an advanced subject which is highly integrated and cross cutting. Robot technology is a set of mechanics, biology, anthropology, computer science and engineering, control theory and control engineering, electronic engineering, artificial intelligence, intelligent sensing, sociology and other disciplines, which is a strongly comprehensive new technology. Through the practicing and learning of this course, we mobilize the initiative of students, inspire the students' innovative thinking, students will learn to literature query, summary analysis and key technology of decomposition, try to refine scientific problems .We guide the students to construct and developed a robotic system, deepen the understanding of students on robotics and system, cultivate and improve the students' comprehensive use of basic theory and professional knowledge in the innovation ability.

Course Outcomes:
After completing this **course**, a student should be able to:
1. Understand the components of the robot and its functional principles and design methods.
2. Understand the thinking mode affecting the performance of robot system.
3. Understand the Working mechanism and design method, electric drive and control system, as well as the performance analysis and improvement of robot system.
4. Briefly analyse the design of the system according to the requirements of robot system, the selection and design of core technology parameters.
5. Propose the scheme of corresponding robot system selection according to various functional requirements, Analyse the factors affecting the performance of the robot system, develop different robot system design and analysis of the mode of thinking.

Course Content:
Lectures and Lecture Hours:
1.Introduction 2
 1.1 Present situation and trend of robot technology development
 1.2 Introduction to robot classification and function
2.Robot system 2
 2.1 The selection of the robot system
 2.2 Selection and design of the core functional components of the robot
 2.3 Processing and purchasing of core functional components of robot
 2.4 Performance testing and integration of the core functional components of the robot
 2.5 Robot system integration and testing
3.Data reorganization and defense 2
 3.1 Data collection, and preparation of documents and PPT
 3.2 Robot system display
 3.3 Defence
Laboratories and Laboratory Hours: 54
Students are divided into several teams. Based on the former experience on designing and making electromechanical systems or robots, each team should work on an innovative intelligent robot. Each team needs to give a presentation weekly. The team members make turns inside. Finally, each team should complete its own electromechanical system and show it in the final defence. The procedure is guided by the teacher.

Grading:

Presentation	15%
Simulation and physical display	50%
Defence	25%
Performance in class	10%

Text & Reference Book:

1 John J Craig. Introduction to robotics. Third Edition, Machinery Industry Press
2 J.M. Selig. The geometric basis of robotics. Tsinghua University Press 2008

102027116 Measurement and Virtual Instruments

Lecture Hours: 32
Laboratory Hours: 16
Credits: 3
Prerequisite(s):

Course Description:
The main goal of this course is for students to learn applications of programming, signal transduction, data acquisition, data analysis, signal processing used in the design of mechanical and electronical instrumentation. The software package LabVIEW has become a standard in academic and industrial environments for data acquisition, interfacing of instruments and instrumentation control. Students in this course will learn LabVIEW as a tool for the design of computer-based virtual instruments, which add software-based intelligence to sensors and basic laboratory bench devices.

Course Outcomes:
- Develop LabVIEW programs called virtual instruments featuring numeric and string manipulation, program structures, data structures, file input-output, outside-world interfacing, data analysis and signal processing;
- Design software applications and graphical user interfaces in LabVIEW using good programming techniques, including documentation, and an understanding of human computer interfaces;
- Analyze a data acquisition system including transducers, signal conditioning elements, and plug-in DAQ computer boards;
- Design a data acquisition system with understanding of the trade-offs for different signal types, number of channels, sampling resolution, and sampling frequency ;
- Experiment, analyze, and document in the laboratory prototype measurement systems using plug-in DAQ, a computer, and bench instruments;
- Integrate knowledge for data analysis and signal processing learned in previous courses in systems for measurement and analysis of signals;
- Function effectively as part of a group of student engineers working on a multi-week project;
- Document in writing and orally exercises and projects performed individually and as part of a team of student engineers;
- Independently acquire through reading, practice exercises, and self-initiated research technical knowledge related to the course content and projects.

Course Content:
The course plan detailed below reflects the course goal and the learning objectives. "Lecture + activities" sessions emphasize the development of LabVIEW programming skills and virtual instrument design skills through knowledge acquisition and practice. Different types of sensors are described and analyzed. Techniques for data analysis and processing of physiologic signals are reviewed and integrated in LabVIEW applications. Homework problems, laboratories, and a final project sharpen the acquired knowledge and skills and extend them to the development of realistic instrumentation systems. The class material is covered in the following tentative order
- Introduction to LabVIEW
- Loops – Graphs – Arrays in LabVIEW
- Case and other structures – Strings – Clusters
- Front panel editing – Boolean operations – Files – Waveforms
- Properties of signals – Data acquisition
- Instrument control basics – Pulse oximetry (student lesson)
- Instrument control with LabVIEW

- Software design principles – Property nodes – Midterm 1
- Component oriented design – Light measurements
- Basic software architectures
- Graphic user interface principles – Creating a medical device company (student lesson)
- Graphic user interface design with LabVIEW – TBD (student lesson)
- Digital signal processing
- Conclusions

Laboratories and Laboratory Hours: None

<u>Grading:</u>

In class Quizzes	40%
Final exam	60%

<u>Text & Reference Book:</u> N/A

Mechanical Engineering

Educational Objectives

The bachelor's degree program provides a professional and application-oriented scientific education, and enables students to gain fundamentals of mathematics, natural sciences and engineering, as well as the in-depth knowledge of specific subjects in Mechanical Engineering. Students can use engineering principles, tools and technologies to identify, formulate and solve engineering problems in mechanical engineering facing the challenges in the future, with the understanding of the impacts in a global and societal context. Students are educated to improve the competence in scientific methodology, research skills, problem solving, creativity, leadership and communication skills in multidisciplinary team, and ability to engage in lifelong learning, with global vision and social responsibility.

The curriculum emphases on fundamental aspects of design, mechanics, materials science, thermal and fluid mechanics, and manufacturing. The program also incorporates courses in electronics, computer programming, automatic control, computer-aided design, research methodology, and multicultural communication. There are also in-depth courses in design and application technologies of vehicle, engine, and energy systems. These courses are taught in theory and also in practice using the experiment and practice platforms in school of mechanical engineering.

The program prepares students to become problem solvers and leaders to contribute to a wide range of industries and businesses, government, and academia. Students will be adaptive learners who continue to grow professionally by obtaining professional registration or certification, or by earning post-graduate degrees.

Core Courses

The curriculum covers the fundamental aspects of design, analysis, and manufacturing in mechanical engineering.

- Courses in natural sciences and mathematics: calculus, chemistry, physics, linear algebra, probability and statistics, and life science.
- Engineering fundamentals: engineering graphics, introduction to engineering, computational methods, research methods, computer-aided design, computer science and programming, electrical and electronics.
- Fundamentals in Mechanical Engineering: static and dynamics, kinematics, materials science, mechanics of materials, electrical and electronics, machine and mechanism design, fluid mechanics, thermodynamics and heat transfer, vibrations, control and instrumentation.
- Major specific courses: energy system, manufacturing, vehicle structure and design, internal combustion engine, engineering economics and management.
- Essential skills in language and communications: international English communication, academic writing, multicultural communication.

Program Outcomes

By the time of graduation, our graduates will have:

- the ability to use applied scientific knowledge and fundamental engineering knowledge to solve problems in mechanical engineering and related fields.
- the ability to design and conduct experiments, as well as to analyse and interpret experimental data for mechanical engineering and related applications.
- the technical ability to design mechanical devices or systems to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- the ability to develop and assess alternative designs of both mechanical and thermal

engineering systems based on technical and non-technical criteria including their impact in a global, economic, environmental, and societal context.
- the ability to use the relevant tools necessary for practice in mechanical engineering and related fields.
- the ability to recognise and achieve high levels of professionalism in their work.
- the ability to assume leadership roles, function on multidisciplinary teams, and communicate effectively and persuasively.
- a critical understanding of ethical responsibility.
- a knowledge of global and contemporary issues.
- a recognition of the need for an ability to engage in lifelong learning and development.

Duration and Degree

4 years. Bachelor of Science in Mechanical Engineering

Curriculum

Semester 1			Credits
100172103	工科数学分析 I	Mathematical Analysis for Engineering I	6
102172501	线性代数 A（双语）	Linear Algebra A	3.5
101190003	大学化学 C （全英文）	General Chemistry C	2
100160502	生命科学基础 B	Principle of Life Science B	1
101080081	计算机科学与编程（全英文）	Computer Science and Programming	3
100245105	国际交流英语 I	International English Communication I	2
100270001	思想道德修养与法律基础	Ideological and Moral Cultivation and Basics of Law	3
100930001	大学生心理素质发展	Psychological Quality Development of College Students	0
100320001	体育 I	Physical Education I	0.5
100980001	军事理论	Military Theory	1
100980002	军事训练	Military Training	1.5
Total Hours			**23.5**

Semester 2			Credits
100172203	工科数学分析 II	Mathematical Analysis for Engineering II	6
101180111	大学物理 I（全英文）	College Physics I	4
100180116	物理实验 B I	Physics Laboratory B I	1
101037302	工程制图（全英文）	Engineering Graphics	4
101080082	C 语言编程实践（全英文）	C Programming Practice	1
100245106	国际交流英语 II	International English Communication II	2
100270002	中国近现代史纲要	The History of Modern China	2
100320002	体育 II	Physical Education II	0.5
Elective	通识教育选修课	General Electives	2
Total Hours			**22.5**

Semester 3			Credits
100172003	概率与数理统计	Probability Theory and Mathematical Statistics	3
100172001	复变函数与积分变换	Complex Variables and Integral Transform	2
101180121	大学物理 II（全英文）	College Physics II	4
100180125	物理实验 B II	Physics Laboratory B II	1
101013001	理论力学（全英文）	Theoretical Mechanics	4
101037326	工程概论（全英文）	Introduction to Engineering	1
101051238	电工与电子技术 I（全英文）	Electrical & Electronics I	2.5
101051295	电工和电子技术实验 I（全英文）	Experiment for Electrical & Electronics I	0.5
101037324	工程设计实践	Engineering Design Practice	2
100051294	电子实习	Electronic Practice (Radio Installation)	1
100270003	马克思主义基本原理概论	Introduction to Basic Principles of Marxism	3
100320003	体育 III	Physical Education III	0.5
Elective	通识教育选修课	General Electives	2
Total Hours			**26.5**

Semester 4			Credits
100031206	计算方法	Computational Methods	2
101037304	机械原理（全英文）	Theory of Machines and Mechanisms	3
101051239	电工和电子技术Ⅱ（全英文）	Electrical & Electronics II	2.5
101051296	电工与电子技术实验 II（全英文）	Experiment for Electrical & Electronics II	0.5
101037305	工程材料与应用（全英文）	Principle and Application of Engineering materials	3
101014001	材料力学（全英文）	Mechanics of Materials	3.5
101037306	热力学（全英文）	Thermodynamics	3
100270004	毛泽东思想与中国特色社会主义理论体系概论	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics	4
100320004	体育 IV	Physical Education IV	0.5
Elective	通识教育选修课	General Electives	2
Total Hours			**24**

Semester 5			Credits
101037307	机械设计（全英文）	Machine Design	3
101037308	机械设计综合课程设计（全英文）	Machine Design Project	2
101037309	传热学（全英文）	Heat Transfer	2
101037310	机械振动（全英文）	Mechanical Vibrations	3
101037311	系统建模与仿真（全英文）	Modelling and Simulation of System	3
101037325	计算机辅助设计与工程（全英文）	Computer -Aided Design and Engineering	3
101037314	嵌入式系统开发（全英文）	Embedded Control System Design	2
101037312	中国文化与跨文化交流（全英文）	Chinese Culture & Cross-Cultural Communications	1
101037303	科学研究与写作（全英文）	Research Methods and Academic Writing	1
101037313	制造技术基础训练	Basic Training of Manufacturing Technology	2
100270005	社会实践	Social Practice	2
Total Hours			**24**

Semester 6			Credits
101037315	控制原理与测试（全英文）	Principle of Control and Instrumentation	3
101037316	流体力学（全英文）	Fluid Mechanics	3
101037317	机械制造与装备（全英文）	Manufacturing and Machine Tools	4
101037318	内燃机构造与原理（全英文）	Internal Combustion Engine Fundamentals	4
101037319	汽车结构与设计（全英文）	Automobile Structure and Design	4
100270006	形式与政策	Situation and Policy	2
Total Hours			**20**

Semester 7			Credits
101037322	能源系统及设计（全英文）	Energy System and Design	3
101037320	工程管理（全英文）	Engineering Management	3
101037321	专业课程设计（全英文）	Engineering Design Project	3
100035402	机械工程专业生产实习	Internship in Industry	3
Total Hours			**12**

Semester 8			Credits
101037323	毕业设计（全英文）	Graduation Design (Thesis)	12
Total Hours			**12**
Total Credit Hours			**164.5**

Course Descriptions

101013001 Theoretical Mechanics

This course is based on the concepts of classical Newtonian mechanics and its application on mechanical systems. This course introduces the mechanical principles that are necessary to understand, analyse and design the mechanisms and machines. The major parts of this course are: I. Statics and Structures; and II. Kinematics and Dynamics. Main topics include vector analysis, statics of rigid bodies, friction, and kinematics of motion, work and energy, and dynamics of particles.

Prerequisite(s): 100172103, 100172203

101014001 Mechanics of Materials

This course is to provide students with a clear and thorough presentation on both the theory and application of fundamental principle of mechanics of materials. After explanation of the physical behaviour of materials under loads, the behaviours of materials are modelled, and then the theories of mechanics of materials are developed. Emphasis is placed on the importance of satisfying equilibrium, compatibility of deformation, and material behaviour requirements. The topics are concepts of statics, definition of normal and shear stress, normal stress in axially loaded members, average shear stress caused by direct shear, the concept of strain, mechanical properties of materials, the mechanical behaviour of structures under axial load, torsion and bending, discussion on thin-walled tubes, shear flow, stress and strain transformation, Mohr's circle, deflections of beams and shafts.

Prerequisite(s): 101180111, 100172103, 101180111 and 101180121

100031206 Computational Methods

This is a basic mathematical course for mechanical engineering students. By studying this course, students should understand the basic principles and methods of scientific computing using numerical methods. Students will learn the methods of solving linear and non-linear equations, interpolation and approximation, differentiation and integration, finding roots of equations and numerical method of ordinary differential equations. Students will also learn the evolution of scientific computing, and can understand how the advances of computing technology boosted the development of scientific computing. Students will be able to apply the knowledge of computational methods in innovative design, engineering analysis, and research.

Prerequisite(s): 100172103, 100172501, 100172401 and 100172001

100035402 Internship in Industry

Internship program provides students the major-related experience in industry. Students are expected to undertake various activities in industry, including industry visit, industrial practice in industry and research firms, seminars and workshops. Specific internships available change from semester to semester. Internship is under faculty supervision. Students should submit the internship report in the end. The minimum duration of internship is 3 weeks.

101037302 Engineering Graphics

This course provides fundamental skills of drafting and interpreting engineering drawings, complying with both international and national standards. The course focuses on representing and interpreting 3D objects on 2D drawings, and formal representation in working drawings. This course also provides fundamental skills of parametric design and drafting of formal drawings using CAD tools. The main focus is representation techniques, including rendering and formal representation of working drawing using CAD tools.

101037304 Theory of Machines and Mechanisms

This course covers the basics of kinematics and dynamics of machinery. Specific topics include kinematic fundamentals; linkage synthesis; position, velocity and acceleration analysis; design and kinematic analysis of cams and gears; dynamic force analysis of linkage; static and dynamic balancing of mechanisms. Matlab is used to analyse and simulate mechanisms in homework and project.

Prerequisite(s): 101013001

101037305 Principle and Application of Engineering Materials

This course provides comprehensive knowledge and insight into the properties, structure and behaviour of engineering materials. The main materials discussed in this course are metal (ferrous and non-ferrous alloy), ceramics, polymers and composite. The structures and properties of these special materials are studied in details, so that students can understand how structure dictates properties and how processing can change structure. Furthermore, the criteria of the selection of materials are discussed.

Prerequisite(s): 101180111, 101180121, 101190003

101037306 Thermodynamics

Thermodynamics is an important technical foundation course for Mechanical Engineering. It's a scientific knowledge which concerns effective using of thermal energy and the conversion rules between thermal energy and other energies, including the first law of thermodynamics, the second law of thermodynamics, the properties of ideal gas, thermal processes of ideal gas, thermodynamics differential equation, thermal properties of the steam and Moist air, dynamic cycles. This course aims to give students a thorough grounding in the subject of thermodynamics and the design of thermal system. This course will explore thermo-energy being utilized efficiently and energy inter-conversion regular patterns.

Prerequisite(s): 101180111, 101180121, 100172103 and 100172203

101037307 Machine Design

This course is an introduction to the basic design principles and methods of mechanical elements and mechanical systems. It provides the students with fundamental skills of engineering design, and the ability to apply the theories of science and engineering to practice. The course focuses on the fundamentals and principles of basic mechanical elements, failure theories and design criteria, and structures of basic mechanical systems. The goal of the course is to learn how to design common mechanical elements and systems.

Prerequisite(s): 101037302, 101014001, 101037304

101037308 Machine Design Project

This is an advanced project-based course in design and integration. It also serves as a best practice for students to learn the way in which machine elements such as bearings, gears, shaft, bolts, cams and mechanisms are used. Modelling and analysis of these elements is based upon extensive application of core mechanical engineering principles. These principles are reinforced through a substantial design project wherein students model, design, fabricate and characterize a mechanical system that is relevant to a real-world application. The main goal of this term project is to practice the knowledge from the prerequisites mainly including the courses such as principle of machine and machine design, and to help students to successfully tackle genuine engineering problems encountered in practice.

Prerequisite(s): 101037307

101037309 Heat Transfer

Heat transfer is a basic science that deals with the rate of transfer of thermal energy. The objectives of this course are to cover the basic principles of heat transfer, which include heat conduction, transient heat conduction, heat convection, convection differential equations, forced convection and free convection, thermal radiation, the Stefan-Boltzmann law, projection radiation and effective radiation, the view factor, the grey surface, enhancement heat transfer and heat exchangers. By learning this course, students should acquire the basic theoretical knowledge of heat transfer law and corresponding calculation methods and skills.

Prerequisite(s): 101180111, 101180121, 100172103 and 100172203

101037310 Mechanical Vibrations

This course is to explore general theory of free, forced, and transient vibrations; vibration transmission, isolation, and measurement; normal modes and generalized coordinates; method of matrix equation formulation and solution. The application of theory and methods to the analysis, measurement and design of dynamic systems will also be introduced in the course.

Prerequisite(s): 102172501

101037311 Modelling and Simulation of System

This course is designed as an introductory undergraduate course in modelling and simulation of dynamic systems. It consists of MATLAB application-based modelling, and control-oriented simulation of dynamic systems. Some fundamental physical rules and engineering methods will be applied to model the typical dynamic systems. Frequency domain-based analysis for dynamic systems will be introduced. Feedback controller will be designed and analysed at the end of the lecture. This course will help the undergraduates to be capable of modelling and simulating variables and typical dynamic systems by using Matlab/Simulink software and enhance their understanding and usage of the numeric algorithm and solver for dynamic systems. The attendees will also build the model-based design methodology and familiarize with some tools and platforms.

Prerequisite(s): 100172103, 100172203, 102172501, 101180111, 101180121, 101013001, 101051238, 101051239

101037312 Chinese Culture and Cross-Cultural Communications

Globalization is one of the major forces shaping our world, and communicating across cultures is a crucial skill for students in the international networks of business, science, and technology. This course is designed to help students establish cultural identity of their own, understand the role of communication in culture and the major cultures in the world, recognize cultural variables and their influences on communication in a diverse world. This course provides students with knowledge and effective skills that help them become sensitive to cultural differences and interact successfully with people from different cultures. This course is taught in English. Students can learn the subjects by lectures, case studies, readings and assignments. The course is conducted as a seminar/workshop. Students are encouraged to participate in discussion, exercises, and presentations. They have variety of opportunities to practice cross-cultural communication by themselves.

101037313 Basic Training of Manufacturing Technology

This course is to explore mechanical manufacturing technologies through lectures and basic trainings. Most of the modern manufacturing methods and typical machine tools will be introduced and used during the course. Basic equipment operating skills will be trained.

Prerequisite(s): 101037302

101037314 Embedded Control System Design

This course is designed as an introductory undergraduate course in embedded control system. Students will learn basic knowledge of a microprocessor, and several basic applications of microprocessor like I/O, interrupt, PWM, and some advanced applications like driving a 1602 LCD, using PWM and H bridge to drive an electric motor. Students will learn the course as well as doing exercise on a learning board, they will write code to realize every function, and finally, they will do a more complicated project to control a robot electric vehicle to trace a black line on the ground. So, students can well understand what a microprocessor can do and how to use them in industrial applications.

Prerequisite: 101080081

101037315 Principle of Control and Instrumentation

This course is an introduction of control and measurement systems to undergraduate students in mechanical engineering. It involves the fields of control engineering and measurement techniques. The main objective is to learn basic control and measuring theory, and understand classical control techniques and sensor applications, and possess the ability of building control and measuring systems. This course covers measurement transducers, structure of measuring system, signal conditioning, measurements of motion and force, mathematical models of mechanical system, state variable models, performance and stability of linear feedback systems, frequency response methods, and digital control techniques.

Prerequisite(s): 101037311

101037316 Fluid Mechanics

Fluid Mechanics is the study of the motion of fluids, and the forces that arise within fluids and on surfaces in contact with a fluid. An understanding of the basic principles and concepts of fluid mechanics is essential to the analysis of any system in which a fluid (gas or liquid) is involved as the working medium. Students will study fluids at rest and in motion for internal and external flows. The course is designed to help students develop meaningful and connected knowledge of main concepts and equations as well as develop the skills and approaches that work effectively in professional practice.

Prerequisite(s): 100172103, 100172203, 101013001, 101014001, 101037306

101037317 Manufacturing and Machine Tools

This course provides comprehensive knowledge and insight into various aspects of manufacturing processes, tooling, and equipment. Its main objective is to introduce a wide array of manufacturing technology to students who are involved in the design and manufacturing of finished products, to provide them with the basic information on manufacturing technologies. The course focuses on fundamentals of manufacturing processes and equipment used to convert raw materials to a final product. It presents diverse manufacturing processes, including casting, bulk deformation, sheet-metal forming, material removal, processing of polymers/plastics and rapid prototyping, processing of metal-powders/ceramics/composites/superconductors, joining and fastening, fabrication of microelectronic and micromechanical devices, surface technology, and computer-age manufacturing. Students are also introduced to the functions performed by a variety of machine tools employed by the modern manufacturing community. In addition, numerical control and industrial robots are covered. Product quality control, automation in manufacturing, health, safety, and environmental aspects in manufacturing are also discussed.

Prerequisite(s): 101037305, 101037304, 101037307, 101037315

101037318 Internal Combustion Engine Fundamentals

This course is intended to discuss the basic operation of internal combustion engines (ICE). It will focus more on the primary concepts, principles. Some detailed structures of internal combustion engine will also be mentioned. Contents include the fundamentals of most common types of internal combustion engines, with emphasis on reciprocating engines. Both spark ignition and compression ignition engines are covered, operating on four-stroke and two-stroke cycles. Main topics include fluid flow, thermodynamics, combustion, heat transfer and friction phenomena, and fuel properties relevant to engine power, efficiency, and emissions.

Prerequisite(s): 101037316, 101037306, 101037309

101037319 Automobile Structure and Design

This course is to explore the specialized knowledge related to the automobile structure and design from a professional engineering viewpoint. The course is the application and upgrade of applied knowledge learned in previous core courses. Its main objective is to introduce both general and key aspects of automobile performances involved in the design process. This course focuses on various driving performances of the automobile from the dynamics point of view. It presents fundamentals of automobile design process, including the overall basic structure and key parts, the performance and evaluating indexes, tire and aerodynamic, equation of ride motion, vibration and suspension, steering and stability, and electronic control and safety. Students are also introduced to the development of modern automobile and world motor industry.

Prerequisite(s): 101037304, 101037311 and 101037315

101037320 Engineering Management

Over the past several decades, engineering work has been more and more complex, understanding and applying business principles to engineering have never been more important. This course is designed for students to get the knowledge and skills required to manage engineering projects and organizations within the company efficiently and productively, which covers the fields of fundamentals of management, project management and engineering economic. The topics of this course include introduction to engineering management; the manager, organization and team; uncertainties and probabilities; engineering evaluation and selection; planning, budgeting, scheduling; resource levelling and allocations; multiple engineering project management; engineering monitoring and controlling; engineering evaluation and termination. A lot of examples are provided to students to practice by their own in laboratories hours. The practice is supervised by instructors. A complete case which includes six parts will be analysed and presented by student groups in the course.

Prerequisite(s): 100172103, 100172203, 102172401

101037321 Engineering Design Project

This course is the design project course in Mechanical Engineering. It is designed for students to practice their knowledge, skills and abilities they have developed in previous courses, to design a mechanical device, components, process or manufacturing system to satisfy a real need with the goal of synthesizing the technical, environmental, economic, and social issues. The students in this course will be working in teams following a design process for developing a product. Real design needs from industry clients or partners are provided to students. The design projects are supervised. There are lectures about design process and important issues of product development. Project team reports and oral presentations are required in the end of the course. This course can help students be more experienced in engineering design and be better prepared to take on professional responsibilities after they graduate.

Prerequisite(s): 101037302, 101037305, 101037307

101037322 Energy System and Design

The structure and technologies of energy systems are changing rapidly. Some of the reasons are: the mitigation of climate change; the rapid depletion of fossil fuels; the reduction of energy consumption so as to maintain a sustainable development. Renewable energies such as biomass, solar etc. have been vastly used, even in developing countries like China.

This course aims to help students identify the major questions in the area of energy resources and energy technologies, and learn how to develop concrete schemes to tackle problems concerned. The course commences with an overview of the main source of carbon emissions, energy production, followed by discussions of different scenarios for an energy mix. Such energy mix relies heavily on the deployment of renewable energy technologies such as biomass, geothermal, hydroelectric, solar, tidal, wave and wind. The scientific and technical foundations of these technologies are examined in order to assess their ultimate potential as well as their practical limitations. As the key contents of the course, fundamental theories and design methods of energy systems using the renewable energies mentioned above are introduced.

Prerequisite(s): 101037306, 101037309

101037323 Graduation Project (Thesis)

Graduation Project (Thesis) is required in the Mechanical Engineering Program for students who aim to receive a Bachelor's degree in Mechanical Engineering. The course provides training for students to be able to work independently on design or research project within the field of mechanical engineering. The student should plan, carry out and report on the project under the supervision of one faculty instructor. The design or research results should be submitted. The dissertation should be submitted based on the student's work in accordance with established academic standards within the stated time frame and budget for resources. The oral defence is required to report the results and finding in thesis.

101037324 Engineering Design Practice

The main purpose of this course is to let students be familiar with engineering design process, design representation, and cooperation in team-work. Students will be working in a group, working on a design project given by instructor or proposed by students themselves, to exercise the ability of problem solving, fundamental mechanical design and design representation in 2D drawings and 3D objects. It's a practice course following the course Engineering Graphics. Students need to manage the design project by themselves including definition of specifications, design parameters, task assignment, project management, means of communication and cooperation. Each project will result in design report, formal representation by engineering drawings, as well as other necessary technical documents.

Prerequisite(s): 101037302

101037325 Computer-Aided Design and Engineering

This course covers the basic knowledge of principles, techniques and applications of computer-aided technologies in product design, analysis, and manufacturing. During this course, students can learn the fundamental principles, theories, and applications of current technologies in computer-aided design (CAD), computer-aided engineering (CAE), and computer-aided manufacturing (CAM). Students can gain the ability of applying the technologies in product design and development environment, and students will be more equipped and confident to solve difficult problems in design and manufacturing.

Prerequisite(s): 101037302, 101080081, 101037307

101051238 Electrical & Electronics I

This is an introductory course of electrical and electronics for engineering students whose major is not electrical or electronics. The course introduces the fundamental theory and experimental skills of basic circuit analysis and measurement, including circuit elements, Kirchholf's Law, resistive circuits, inductance and capacitance, transients, etc. The steady-state sinusoidal analysis, frequency response and resonance are discussed. Diodes, amplifiers, and bipolar junction transistor are also taught with introduction of industrial applications.

Prerequisite(s): 100172103, 100172203, 101180111 and 101180121

101051239 Electrical & Electronics II

This is the second part of the introductory course of electrical and electronics for non-electrical or electronics majored engineering students. This course covers various topics on digital circuit analysis, electromechanical engineering and electrical controlling. Students will learn to conduct analysis of basic combinational and sequential logic circuit, basic AC motor design, and to apply circuit to industrial applications.

Prerequisite(s): 100172103, 100172203, 101180111 and 101180121

101051295 Experiment for Electrical & Electronics I

This experimental course supplements the course 101051238 Electrical & Electronics(I). In this course, students will do 8 experiments in electrical measurement, RLC circuits, AC circuits, amplifier, and the applications of op-amp.

Prerequisite(s): 100172103, 100172203, 101180111 and 101180121

101051296 Experiment for Electrical & Electronics II

This experimental course supplements the course 101051239 Electrical & Electronics(II). In this course, students will do 8 experiments in rectifier, filter and voltage regulator circuit, combination and sequential logic circuits, application of transformer, Relay-contactor control systems, and S7-200 PLC.

Prerequisite(s): 100172103, 100172203, 101180111 and 101180121

Course Syllabus

101013001 Theoretical Mechanics

Lecture Hours: 64
Laboratory Hours: 0
Credits: 4
Prerequisite(s): 100172103, 100172203

Course Description:
This course is based on the concepts of classical Newtonian mechanics and its application on mechanical systems. This course introduces the mechanical principles that are necessary to understand, analyse and design of mechanisms and machines. The major parts of this course are: I. Statics and Structures; and II. Kinematics and Dynamics. Main topics include vector analysis, statics of rigid bodies, friction, and kinematics of motion, work and energy, and dynamics of particles.

Course Outcomes:
The objectives of this course are:
1. To help students cultivate the ability to analyse the motion of an object;
2. To be able to perform a kinematic analysis as well as a kinetic analysis of an object experiencing either particle motion or planar motion.

Course Content:
Lectures and Lecture Hours:

1 General Principles 2
- Mechanics
- Fundamental Concepts
- Units of Measurement
- The International System of Units
- Numerical Calculations

2 Force System Resultants 6
- Moment of a Force–Scalar Formulation
- Cross Product
- Moment of a Force–Vector Formulation
- Principle of Moments
- Moment of a Force about a Specified Axis
- Moment of a Couple
- Simplification of a Force and Couple System
- Further Simplification of a Force and Couple System
- Reduction of a Simple Distributed Loading

3 Equilibrium of a Rigid Body 6
- Conditions for Rigid-Body Equilibrium
- Free-Body Diagrams
- Equations of Equilibrium
- Free-Body Diagrams
- Equations of Equilibrium
- Constraints and Static Determinacy

4 Structural Analysis 6
- Simple Trusses
- The Method of Joints
- Zero-Force Members
- The Method of Sections

- Space Trusses
- Frames and Machines

5 Friction 4

- Characteristics of Dry Friction
- Problems Involving Dry Friction
- Wedges
- Frictional Forces on Screws
- Frictional Forces on Flat Belts
- Frictional Forces on Collar Bearings, Pivot Bearings, and Disks
- Frictional Forces on Journal Bearings
- Rolling Resistance

6 Virtual Work 4

- Definition of Work
- Principle of Virtual Work
- Principle of Virtual Work for a System of Connected Rigid Bodies
- Conservative Forces
- Potential Energy
- Potential-Energy Criterion for Equilibrium
- Stability of Equilibrium Configuration

7 Kinematics and Kinetics of a Particle 4

- General Curvilinear Motion
- Curvilinear Motion： Rectangular Components
- Curvilinear Motion： Normal and Tangential Components
- Curvilinear Motion： Cylindrical Components
- Newton's Laws of Motion
- The Equation of Motion
- Equation of Motion for a System of Particles
- Equations of Motion： Rectangular Coordinates
- Equations of Motion： Normal and Tangential Coordinates
- Equations of Motion： Cylindrical Coordinates
- Central-Force Motion and Space Mechanics

8 Planar Kinematics of a Rigid Body 6

- Rigid Body Motion
- Translation
- Rotation about a Fixed Axis
- Absolute General Plane Motion Analysis
- Relative Motion Analysis: Velocity
- Instantaneous Center of Zero Velocity
- Relative Motion Analysis: Acceleration
- Relative Motion Analysis Using Rotating Axes

9 Planar Kinetics of a Rigid Body：Force and Acceleration 6

- Moment of Inertia
- Planar Kinetic Equations of Motion
- Equations of Motion：Translation
- Equations of Motion：Rotation About a Fixed Axes
- Equations of Motion：General Plane Motion

10 Planar Kinetics of a Rigid Body：Work and Energy 4

- Kinetic Energy
- The Work of a Force
- The Work of a Couple
- Principle of Work and Energy
- Conservation of Energy

11 Planar Kinetics of a Rigid Body： Impulse and Momentum 4
- Linear and Angular Momentum
- Principle of Impulse and Momentum
- Conservation of Momentum
- Eccentric Impact

12 Three-Dimensional Kinematics of a rigid Body 4
- Rotation about a Fixed Point
- The Time Derivative of a Vector Measured from Either a Fixed and Translating Rotating System
- General Motion
- Relative Motion Analysis Using Translating and Rotating Axes

13 Three-Dimensional Kinetics of a Rigid Body 4
- Moments and Products of Inertia
- Angular Momentum
- Kinetic Energy
- Equations of Motion
- Gyroscopic Motion
- Torque Free Motion

14 Vibrations 4
- Undamped Free vibration
- Energy Methods
- Undamped Forced Vibration
- Viscous Damped Free Vibration
- Viscous Damped Forced Vibration
- Electrical Circuit Analogs

Grading:

Homework	5%
Inclass Quizzes	5%
Two Midterm Exams	20%
Final	70%

Text & Reference Book:

Textbook:

Russell C. Hibbeler, Engineering Mechanics: Combined Statics & Dynamics (12th Edition) , Prentice Hall; May 3, 2009

References:

1. Bedford and Fowler. Engineering Mechanics: Statics. 5th Edition. Prentice Hall
2. J. L. Meriam and L. G. Kraige (1997) Engineering Mechanics: Dynamics, 4th Edition, John Wiley & Sons, New York.
3. Pytel, Andrew and Jaan Kiusalaas (1999) Engineering Mechanics: Dynamics, 2nd Edition, Brooks/Cole Publishing, Pacific Grove, California.
4. Ginsberg, Jerry H. (1995) Advanced Engineering Dynamics, 2nd Edition, Cambridge University Press, New York.

101014001 Mechanics of Materials

Lecture Hours: 48
Laboratory Hours: 8
Credits: 3.5
Prerequisite(s): 101180111, 100172103, 101180111 and 101180121

Course Description:
This course is to provide students with a clear and thorough presentation on both the theory and application of fundamental principle of mechanics of materials. After explanation of the physical behaviour of materials under loads, the behaviours of materials are modelled, and then the theories of mechanics of materials are developed. Emphasis is placed on the importance of satisfying equilibrium, compatibility of deformation, and material behaviour requirements. The topics are concepts of statics, definition of normal and shear stress, normal stress in axially loaded members, average shear stress caused by direct shear, the concept of strain, mechanical properties of materials, the mechanical behaviour of structures under axial load, torsion and bending, discussion on thin-walled tubes, shear flow, stress and strain transformation, Mohr's circle, deflections of beams and shafts.

Course Outcomes:
After completing this course, a student should be able to:
1. Calculate and understand the concepts of stress and strain;
2. Calculate, describe, and estimate external loadings, including axial load, shear force, bending, and torsion, and the resulting deformations and internal stresses associated with these external loadings;
3. Calculate and describe the internal stresses and deformations that result in combined loading conditions;
4. Calculate internal stresses and strains through the application of stress transformation equations and Mohr's circle;
5. Design components to meet desired needs in terms of strength and deformation.
6. Foster effective mathematical and graphical communication skills.
7. Cultivate ethical engineering decisions

Course Content:
Lectures and Lecture Hours:
1. Stress 4
   - Equilibrium of a Deformable Body
   - Stress
   - Average Normal Stress in an Axially Loaded Bar
   - Average Shear Stress
   - Allowable Stress
2. Strain 2
   - Deformation
   - Strain
3. Mechanical Properties of Materials 4
   - The Tension and Compression Test
   - The Stress-Strain Diagram
   - Stress-Strain Behaviour of Ductile and Brittle Materials
   - Hooke's Law
   - Strain Energy
   - Poisson's Ratio
   - The Shear Stress-Strain Diagram
4. Axial Load 4
   - Saint-Venant's Principle

- Elastic Deformation of Axially Loaded Member
- Principle of Superposition
- Statically Indeterminate Axially Loaded Member
- The Force Method of Analysis for Axially Loaded Members
- Thermal Stress
- Stress Concentration

5. Torsion 4
   - Torsion Deformation of a Circular Shaft
   - The Torsion Formula
   - Power Transmission
   - Angle of Twist
   - Statically Indeterminate Torque-Loaded Members
   - Stress Concentration
6. Bending 6
   - Shear and Moment Diagrams
   - Graphical Method for Constructing Shear and Moment
   - Bending Deformation of a Straight Member
   - The Flexure Formula
   - Unsymmetric Bending
   - *Composite Beams
   - Stress Concentrations
7. Transverse Shear 6
   - Shear in Straight Members
   - The Shear Formula
   - Shear Stresses in Beams
   - Shear Flow in Built-up Members
   - Shear Flow in Thin-walled Members
8. Combined Loadings 4
   - Thin-Walled Vessels
   - State of Stress Caused by Combined Loadings
9. Stress and Strain Transformation 6
   - Plane-Stress Transformation
   - General Equations of Plane-Stress Transformation
   - Principal Stresses and Maximum In-Plane Shear Stress
   - Mohr's Circle-Plane Stress
   - Absolute Maximum Shear Stress
   - Plain Strain
   - General Equations of Plain-Strain Transformation
   - *Absolute Maximum Shear Strain
   - Strain Rosettes
   - Material-Property Relationships
   - *Theories of Failure
10. Deflections of Beams and Shafts 8
    - The Elastic Curve
    - Slope and Displacement by Integration
    - Slope and Displacement by the Moment-Area Method
    - Method of Superposition
    - Statically Indeterminate Beams and Shafts-Method of Integration
    - Statically Indeterminate Beams and Shafts-Moment-Area Method
    - Statically Indeterminate Beams and Shafts-Method of Superposition

Laboratories and Laboratory Hours:

1. Low Carbon Steel Tensile Test	2
2. Grey Cast Iron Tensile Test	2
3. Deflection Measurement for Metallic Beams	2
4. Deformation Measurement for Metallic Beam under Combined Bending and Torsion Loadings	2

Grading:

Homework	20%
Lab Report	10%
Final	70%

Text & Reference Book:

R. C. Hibbeler, Mechanics of Materials, 5th ed., 2004, ISBN 7-04-014008-X.

100031206 Computational Methods

Lecture Hours: 28
Laboratory Hours: 4
Credits: 2
Prerequisite(s): 100172103, 100172501, 100172401 and 100172001

Course Description:

This is a basic mathematical course for mechanical engineering students. By studying this course, students should understand the basic principles and methods of scientific computing using numerical methods. Students will learn the methods of solving linear and non-linear equations, interpolation and approximation, differentiation and integration, finding roots of equations and numerical method of ordinary differential equations. Students will also learn the evolution of scientific computing, and can understand how the advances of computing technology boosted the development of scientific computing. Students will be able to apply the knowledge of computational methods in innovative design, engineering analysis, and research.

Course Outcomes:

After completing this course, a student should be able to:

1. Use computer science, programming, scientific computing and the basic knowledge of engineering to model, characterize and explain the complex engineering calculation problem in the field of engineering.
2. Apply the basic principles of engineering science to analyse the encountered engineering calculation model and the space complexity, time complexity and the computational stability of the used computing methods, then analyse and verify the rationality of the computation.
3. Design and integrate the solution to the encountered complex engineering calculation problem.
4. Use the modern tools like software package and computing platform to design, model and express the complex engineering calculation problems.

Course Content:

Lectures and Lecture Hours:

1. Error	2
1.1 Source of Error	
1.2 Absolute Error, Relative Error and Significant Figures	
1.3 Spread of Error in Numerical Calculation	
1.4 Problems That Should Be Paid Attention to in the Numerical Calculation	
2. Direct Method of Solving Linear Equations	5
2.1 Method of Gauss Elimination	
2.2 Method of Pivot Element Elimination	
2.3 Method of Direct Triangle Decomposition	
2.4 Method of Cholesky Decomposition and Improved Cholesky Decomposition	
2.5 Error Analysis	
3. Iterative Method of Solving Linear Equations	2
3.1 Summarization of Iterative Method	
3.2 Method of Jacobi Iteration	
3.3 Method of Gauss-Seidel Iteration	
3.4 Convergence Conditions of Iterative Method	
4. Method of Interpolation	5
4.1 Lagrange Interpolation	
4.2 Newton Interpolation	
4.3 Piecewise Linear Interpolation	
4.4 Hermite Interpolation	
4.5 Spline Interpolation	
5. Approximation of Functions	2

5.1 Data Fitting Least Squares
5.2 Orthogonal Polynomials

6. Numerical Differentiation and Numerical Integration 5
6.1 Numerical Differentiation
6.2 Newton-Cotes Quadrature Formula
6.3 Composite Integration Rule
6.4 Romberg Quadrature Formula
6.5 Gaussian Quadrature Formula

7 Solution of Nonlinear Equation and Nonlinear Equations 2
7.1 Method of opposite divided intervals
7.2 Simple Iteration
7.3 Newton Method and Secant Method

8 Numerical Methods for Ordinary Differential Equations 5
8.1 Euler Method
8.2 Improved Euler Method
8.3 Runge-Kutta Method
8.4 Linear Multistep Method
8.5 Compatibility, Convergence and Stability

Laboratories and Laboratory Hours: **4**

Chapter 1,2,3,4 Computer Calculation (2 class hours)
Chapter 5,6,7,8 Computer Calculation (2 class hours)

<u>Grading:</u>

Homework	15%
Project	10%
Final	70%
Instructor Evaluation	5%

<u>Text & Reference Book:</u>

Textbooks:

Ding Lijuan, Cheng Jiyuan. Numerical Calculation Method. [M].2th ed. Beijing: Being Institute of Technology Press,2008.

References:

Li Qingyang, Wang Nengchao, Yi Dayi. Numerical Analysis. [M]. 5th ed. Beijing: Tsinghua University Press, 2008.

Shi Miaogen, Gu Lizhen. Science and Engineering Calculation Basis. [M]. Beijing: Tsinghua University Press, 1999.

100035402 Internship in Industry

Lecture Hours:
Laboratory Hours:
Credit: 3

Course Description:

Internship program provides students the major-related experience in industry. Students are expected to undertake various activities in industry, including industry visit, industrial practice in industry and research firms, seminars and workshops. Specific internships available change from semester to semester. Internship is under faculty supervision. Students should submit the internship report in the end. The minimum duration of internship is 3 weeks.

Grading:

Participation:	20%
Internship report:	80%

101037302 Engineering Graphics

Lecture Hours: 56
Laboratory Hours: 8
Credits: 4
Prerequisite(s):

Course Description:

This course provides fundamental skills of drafting and interpreting engineering drawings, complying with both international and national standards. The course focuses on representing and interpreting 3D objects on 2D drawings, and formal representation in working drawings. This course also provides fundamental skills of parametric design and drafting of formal drawings using CAD tools. The main focus is representation techniques, including rendering and formal representation of working drawing using CAD tools.

The main contents are as follow:

1. Introduction to engineering design graphics, review of basic fabrication processes, international and national standards on engineering drawing, the fundamentals of orthographic projection with applications of 3D visualization and view writing, engineering sketching, geometric dimensioning and tolerancing, drawing conventions and representation of 3D geometry on 2D media, simplification of standard part or feature such as thread, gear and so on, and most importantly, working drawing including detail drawing and assembly drawing.
2. The use of 2D CAD software is briefly introduced in this course and homework can be done with drawing equipment or AUTOCAD.
3. Introduction to the concept of parametric design, basic features such as extrusion, rotation, sweep and lofts. Situations when a working (sketch) plan is necessary and the methods of building a working plan. Constrains and sketching technique. Supplementary features such as rib, holes, thread, chamfer, fillets and so on.
4. Assembly constructions and part modelling under assembly environment; Formal engineering drawing of parts; modified the representation of standard parts such as gears, spring, gears as defined in GB or ISO standard; the function and application of representation such as section view, auxiliary view, half section view, broken out section view and so on; besides working drawing, rendering part and assembly is also an effective way of representation.

Course Outcomes:

After accomplishing this course, students should:

1. Have the basic concept of mechanical design and representation and be familiar with the common mechanical structures and their fabrication processes.
2. Be familiar with freehand sketch for design concept communication.
3. Be expert in engineering drawing interpretation, can smoothly switch between the 1st and the 3rd projection system in drawing interpretation and representation, and have the fundamental skills of engineering drawing writing with drawing equipment and AUTOCAD software.
4. Demonstrate a thorough understanding of how to represent a part or an assembly with 2D views, conventions, auxiliary views and section views according its characteristic, which is the foundation of making working drawing with modelling software in design practice project.
5. Have a good knowledge in national and international drawing standards and understand how these standards and simplification of standard structure make the representation clearer.
6. Have the ability of dimensioning without repetition and omission; be familiar with the contents in detail drawing and assembly drawing.
7. Understand the basic concept of parametric design.
8. Be familiar with procedures of solids modelling and feature modelling of INVENTOR.
9. Be expert in engineering drawing representation using modelling software, knowing how to

adapt to corresponding method such as conventions, auxiliary views and section views according the characteristic of the part or assembly to be described.

10. Be expert in revising the representation and simplifying the automatic result of the software if it fails to meet the drawing standard.
11. Demonstrate a strong ability of mechanical design and making formal standard working drawing with modelling software.

Course Content:

Lectures and Lecture Hours:

1.	Introduction	2
2.	Brief on drawing standard	2
3.	Drawing equipment and usage, Instrumental Drawing	2
4.	Geometric Constructions	2
5.	Orthographic projection	2
6.	Orthographic writing	2
7.	Orthographic Reading exercise	2
8.	Dimensioning	2
9.	Orthographic Convention	2
10.	Auxiliary view and section	2
11.	Convention in section	2
12.	Thread Fastene	2
13.	Working Drawing -Detailed drawing	2
14.	Detailed drawing reading exercise	2
15.	Working Drawing -Assembly drawing	2
16.	Assembly drawing reading exercise	2
17.	Pictorial drawing and Free sketch 2	
18.	Concept and procedure of parametric design, Sketching and Constraints	2
19.	Solids modelling, features.	4
20.	Supplementary sketching planes	2
21.	Duplicate features, Arrays and mirror	2
22.	Dimension and parameter transfer	2
23.	Part rendering	2
24.	Formal engineering drawing of parts	4
25.	Assemblies	2
26.	Part design under assembly environment	2
27.	Formal engineering drawing of assemblies	4
28.	Simplify of standard structure (Key, gears, bearing)	2
29.	Elementary Tolerances and dimension fitting in assembly drawing	2

Laboratories and Laboratory Hours:

1. Drawing standard and arc connection	2
2. Orthographic repsentation	2
3. 2D representation	2
4. Detail drawing or assembly drawing	2

Additional more than 32 lab hours after class is necessary for modelling software practicing.

Grading:

The performances of students are evaluated by homework, and midterm or final exams.

Homework	20~30%
Midterm Exam	40~35%
Final Exam (with Midterm Exam)	40~35%
Final Exam (without Midterm Exam)	80~70%

Text & Reference Book:

1. Cecil Jensen. JAY. Engineering Drawing & Design, 7th Edition. ISBN 978-0073521510 McGraw-Hill Higher Education, 2008
2. Giesecke, Frederick E, Mitchell, Alva. Technical Drawing, Twelfth Edition. ISBN 978-0130081834. Pearson Education, 2003.

101037304 Theory of Machines and Mechanisms

Lecture Hours: 42
Laboratory Hours: 6
Credits: 3
Prerequisite(s): 101013001

Course Description:
This course covers the basics of kinematics and dynamics of machinery. Specific topics include kinematic fundamentals; linkage synthesis; position, velocity and acceleration analysis; design and kinematic analysis of cams and gears; dynamic force analysis of linkage; static and dynamic balancing of mechanisms. Matlab is used to analyse and simulate mechanisms in homework and project.

Course Outcomes:
Upon completing this course, students are able to:
1. Synthesize a mechanism using graphical and analytical methods for a given path, motion or function generation task.
2. Perform kinematic analysis to obtain position, velocity, and acceleration of a designed mechanism.
3. Perform kinetic analysis to determine dynamic forces of a designed mechanism.
4. Design and analyse cam and gear mechanisms.
5. Use Matlab to analyse and simulate mechanisms.

Course Content:
Lectures and Lecture Hours:

1.	Introduction - Purpose - Kinematics and kinetics - Mechanisms and machines - Design process	2
2.	Kinematics fundamentals - Mechanism terminology - Kinematic diagrams - Kinematic inversion - Degrees of freedom or mobility - The four- bar mechanism - The slider- crank mechanism	4
3.	Position and displacement analysis - Introduction - Position analysis - Displacement analysis - Limiting position - Transmission angle	2
4.	Mechanism design - Introduction - Time ratio - Design of slider - crank mechanisms - Design of crank - rocker mechanisms - Two-position synthesis - Three-position synthesis	3
5.	Velocity analysis - Introduction - Relative velocity method - Instant center method	4

	- Graphical velocity analysis	
	- Analytical velocity analysis	
6.	Acceleration analysis	4
	- Introduction	
	- Relative acceleration method	
	- Graphical acceleration analysis	
	- Analytical acceleration analysis	
	- Design project: analysis and simulation of linkage mechanisms	
7.	Cams: design and kinematic analysis	9
	- Introduction	
	- Type of cams	
	- Type of followers	
	- Prescribed follower motion	
	- Follower motion schemes	
	- Graphical disk cam profile design	
	- Pressure angle	
	- Design limitation	
8.	Gears: design and kinematic analysis	10
	- Introduction	
	- Type of gears	
	- Spur gear terminology	
	- Involute tooth profile	
	- Standard gears	
	- Relationships of gears in mesh	
	- Spur gear kinematics	
	- Spur gear selection	
	- Helical gear kinematics	
	- Worm gear kinematics	
	- Gear trains	
	- Planetary gear trains	
9.	Dynamic force analysis	4
	- Introduction	
	- Force analysis of the four-bar linkage	
	- Force analysis of the slider- crank linkage	
	- Balancing of rigid rotors	

Laboratories and Laboratory Hours:

1. Structure analysis and kinematic diagram drawing for mechanism	2
2. Experiment on gear generating	2
3. Experiment on dynamic balance system of rigid rotor	2

Grading:

Homework	15%
Presentations	10%
Inclass Quizzes	10%
Project	15%
Final	50%

Text & Reference Book:

1. Robert L. Norton, Design of Machinery: An Introduction to Synthesis and Analysis of Mechanisms and Machines, 4th ed., 2008, ISBN 978-0-07-312158-1.
2. David H. Myszka, Machines and Mechanism: Applied Kinematic Analysis, 4th ed., 2012, ISBN 978-0-13-215780-3.

101037305 Principle and Application of Engineering Materials

Lecture Hours: 40
Laboratory Hours: 8
Credits: 3
Prerequisite(s): 101180111, 101180121, 101190003

Course Description:

This course provides comprehensive knowledge and insight into the properties, structure and behaviour of engineering materials. The main materials discussed in this course are metal (ferrous and non-ferrous alloy), ceramics, polymers and composite. The structures and properties of these special materials are studied in details, so that students can understand how structure dictates properties and how processing can change structure. Furthermore, the criteria of the selection of materials are discussed.

Course Outcomes:

After taking this course, students should:

1. Describe the atomic and crystal structure and chemical bond types, and understand how these affect material properties.
2. Know mechanical and thermal properties of materials and why a specific material is suited to particular applications.
3. Understand the unique characteristics of ceramics, polymers and metallic materials with an introduction to their engineering applications.
4. Understand and experience in testing material properties, with an emphasis on mechanical properties.
5. Further develop their professional competence through working in group assignments; practicing written, oral and graphical communication skills.

Course Content:

Lectures and Lecture Hours:

1.Introduction	1
2.Atomic Structure and Interatomic Bonding	2
- Primary and Secondary Interatomic Bonding	
- Bond Types and Materials Classification	
3.The Structure of Crystalline Solids	2
- Crystalline Structures	
- Crystallographic Points, Directions and Planes	
- Crystalline and Non-crystalline Materials	
4.Imperfections in Solids	2
- Crystalline Imperfections in Metals (Point Defects, Linear Defects, Planar Defects)	
- Various Strength Mechanisms (Solid Solution, Work Hardening, Fine Grains, etc.)	
5.Diffusion	2
- Mechanisms of Atomic Diffusion (Vacancy Diffusion, Interstitial Diffusion)	
- Factors that Influence Diffusion (Temperature, Activation Energy, Short-circuit Diffusion)	
6.Mechanical Properties of Metals	2
- Stress-Strain Behaviour	
- Tensile Properties	
- Flexural Strength	
- Hardness	

7.Dislocations and Strengthening Mechanisms	2
- Plastic Deformation Mechanisms of Metals (Slipping, Twinning)	
- Mechanisms of Strengthening in Metals (Grain Size Reduction, Solid-Solution, Secondary Phases, Cold Working)	
8.Failure	2
- Fracture	
- Fatigue	
- Creep	
9.Phase Diagrams	4
- Phase, Microstructure	
- Phase Rule, Lever Rule	
- Binary-Alloy Phase Diagrams	
- Fe-Fe3C Phase Diagram	
10.Phase Transformations in Metals	6
- Heat Treatment of Steels (TTT Diagram, CCT Diagram)	
- Typical Heat Treatment Methods (Annealing, Normalizing, Quenching, Tempering, Spheroidizing, etc.)	
11.Applications and Processing of Metal Alloys	4
- Types of Metal Alloys	
- Fabrication of Metals	
- Thermal Processing of Metals	
12.Ceramics	2
- Ceramics Structures	
- Applications and Processing of Ceramics	
13.Polymers	2
- Polymer Structures	
- Mechanical Behaviour of Polymers	
- Polymer Types	
14.Composites	2
- Reinforcements	
- Matrix	
15.Corrosion and Degradation of Materials	2
- Corrosion	
- Degradation	
16.Electrical, Thermal, Magnetic and Optical Properties	2
- Low Thermal Expansion Alloys	
- Thermal Barrier Coatings (TBC)	
- Dielectric, Ferroelectric, Piezoelectric Materials	
- Soft, Hard Magnets	
- Optical Fibber, Laser	
17.Economic, Environmental, and Societal Issues in Materials Science and Engineering	1
- Economic Considerations	
- Environmental and Societal Considerations	

Laboratories and Laboratory Hours:

1. Crystallography Experiment	2
2. Metallography	2
3. The effect of heat treatment on the microscopic structure and hardness	2
4. Unknown Polymer Identification	2

Grading:

Homework	10%
Inclass Quizzes	10%

Group Presentation	15%
Midterm Exam	20%
Final	40%
Instructor Evaluation	5%

Text & Reference Book:

1. Materials Science and Engineering An Introduction. William D. Callister, Jr. and David G. Rethwisch, John Wiley and Sons, Inc., 5th or any other update edition, 2000.
2. Foundations of Materials Science and Engineering. Willian F. Smith, Javad Hashemi. Mc Graw-Hill, 5th edition, April 9, 2009.

101037306 Thermodynamics

Lecture Hours: 44
Laboratory Hours: 4
Credits: 3
Prerequisite(s): 101180111, 101180121, 100172103 and 100172203

Course Description:
Thermodynamics is an important technical foundation course for Mechanical Engineering. It's a scientific knowledge which concerns effective using of thermal energy and the conversion rules between thermal energy and other energies, including the first law of thermodynamics, the second law of thermodynamics, the properties of ideal gas, thermal processes of ideal gas, thermodynamics differential equation, thermal properties of the steam and Moist air, dynamic cycles. This course aims to give students a thorough grounding in the subject of thermodynamics and the design of thermal system. This course will explore thermo-energy being utilized efficiently and energy inter-conversion regular patterns.

Course Outcomes:
After completing this course, a student should be able to:
1. Understand a series of basic concepts and the macro research methods of thermodynamics, having the preliminary ability of making thermodynamic models.
2. Master effective using of thermal energy and the conversion rules between thermal energy and other energies.
3. Calculate thermo-technical problems expertly by using property formula and charts of the working fluid.
4. Master thermal process and the basic analysis method for thermodynamic cycle.
5. Learn the basic principles and main ways to improve energy efficiency.

Course Content:
Lectures and Lecture Hours:

1.Preface and basic concepts 2
- Thermal Energy and Utilization
- Thermodynamic System
- Thermodynamic State and State Parameters
- Thermodynamic Process
- Work and Heat Quantity
- Thermodynamic Cycle

2. The first law of thermodynamics 4
- The Essence of The First Law of Thermodynamics
- Internal Energy and Enthalpy
- Basic Energy Equation for The First Law of Thermodynamics
- Thermodynamics Analysis of Closed System for The First Law of Thermodynamics
- Thermodynamics Analysis of Open System for The First Law of Thermodynamics

3. The properties of ideal gas 2
- Ideal Gas Model
- Idea-Gas Equation of State
- Heat Capacity for Ideal Gas
- Internal Energy, Enthalpy, and Entropy for Idea Gasses
- Ideal Gas Mixtures

4. Thermal processes of ideal gas 4
- Objective and General Method to Study Ideal Gas Thermal Processes
- Constant Volume Process
- Constant Pressure Process
- Constant Temperature Process
- Adiabatic Process

- Polytrophic Process
- Thermal Process for Gas Compressor

5.The second law of thermodynamics 6

- The Carnot Cycle and Carnot Theorem
- The Clausius Inequality
- Entropy and The Second Law of Thermodynamics
- Increase in Entropy Principle for an Isolated System
- The Energy Devaluation in Irreversible Process
- Thermodynamic Class Test and presentations

6. Thermodynamics differential equation 4

- Thermodynamic basic relations
- Maxwell Relations and Thermal Coefficient
- General Equation of Internal Energy, Enthalpy, and Entropy
- General Equation of Heat Capacity
- Adiabatic Flow with Friction Drag, Adiabatic Throttle

7. Thermal properties of the steam 2

- Phase Transition
- Saturation Temperature and Saturation Pressure
- States and Parameters of The Water and The Steam
- Basic Thermal Process of The Steam

8.Exergy Analysis 4

-Introducing Exergy
-Defining Exergy
-Closed System Exergy Balance
-Flow Exergy
-Exergy Rate Balance for Control Volumes
Thermodynamic problems and seminar

9.Moist air 4

- The Concept of The Moist Air
- Humidity
- State parameters of The Moist Air and Enthalpy-Humidity Chart
- Thermal Process Analysis of The Steam

10.Dynamic cycles 4

- General Method to Analyse Dynamic Cycle
- Ideal Cycle and Analysis for Piston Internal Combustion Engine
- Cycle and Analysis for Gas Turbine Engines
- Cycle and Analysis for Steam Turbine Engines

11.Chemical and Phase Equilibrium 4

- Introducing Equilibrium Criteria
- Equation of Reaction Equilibrium
- Calculating Equilibrium Compositions
- Equilibrium Between Two Phases of a Pure Substance

12.Thermodynamic Class review and seminar 4

- Thermodynamic review and presentations
- Thermodynamic Special Topics

Laboratories and Laboratory Hours:

1.Energy and principle of thermal engine 2

Steam Power Equipment
Internal Combustion Engine (Petrol Engine and Diesel Engine)
Turbojet Engine
Solid-Propellant Rocket Engine
Atomic Power Station (Skeleton Map)
Compressor
Turbocharger

2.Measure of Average Polytropic Exponent 2

Drawing Indicator Diagram of Compressor

According to Indicator Diagram, Calculate Indicated Power and Average Polytrophic Exponent of The Compression Process

Combining The Theoretical Calculation, Analyse The Influence Caused By Various Factors To Average Polytropic Exponent and The Changes Of Average Polytropic Exponent During The Compression Process

Present A Plan Using Modern Testing Method to Get The Data Above

Grading:

Prerequisite quiz	3%
Homework	10%
In class Quizzes	5%
Group Presentation	5%
2 Midterm Exams	40%
Project	15%
Final	17%
Instructor Evaluation	5%

Text & Reference Book:

Michael J. Moran. Fundamentals of Engineering Thermodynamics. Wiley; 6th edition, March 9, 2007. (NLC: 2-2010\TK123\M829/2010)

101037307 Machine Design

Lecture Hours: 42
Laboratory Hours: 6
Credits: 3
Prerequisite(s): 101037302, 101014001, 101037304

Course Description:
This course is an introduction to the basic design principles and methods of mechanical elements and mechanical systems. It provides the students with fundamental skills of engineering design, and the ability to apply the theories of science and engineering to practice. The course focuses on the fundamentals and principles of basic mechanical elements, failure theories and design criteria, and structures of basic mechanical systems. The goal of the course is to learn how to design common mechanical elements and systems.

Course Outcomes:
After completing this course, the student should be able to:
1. Understand the failure modes and design theories of typical mechanical elements.
2. Master the design criteria of basic mechanical elements.
3. Know well the typical structures of basic mechanical elements.
4. Know well the design process of typical mechanical elements.
5. Design basic mechanical elements.
6. Design simple mechanical systems.

Course Content:
Lectures and Lecture Hours:

1.Introduction to Machine design 2
- Mechanical Engineering design
- Basic concepts
- Design tools and resources

2.Failure theories 4
- Failures resulting from static loading
- Fatigue failures resulting from variable loading

3.Friction, lubrication and wear 4
- Basic friction theory and contact
- Lubrication
- Wear process

4.Transmission elements – Belt drive 4
- Introduction to belt drives
- Working principle of typical belt drives
- Belt drive design

5.Transmission elements – Gear trains 6
- Force analysis of gearing
- Typical failure modes of gears
- Theory of Surface contact fatigue strength
- Theory of tooth root bending fatigue strength
- Design of gear set and parameters determination
- Structure of gears

6.Transmission elements – Worm gears 2
- Worm-gear analysis
- Designing a Worm-gear Mesh

7.Shafts and axles 4
- Introduction
- Geometric and strength constraints
- Shaft materials

- Shaft design

8.Rolling element bearings	4
- Bearing types	
- Bearing life	
- Combined radial and thrust loading	
- Mounting and Enclosure	
9.Fluid-film bearings	4
- Structure of Journal bearing and materials	
- Hydrodynamic theory	
- Designing fluid-film journal bearing	
- Designing boundary-lubricated bearing	
10.Friction elements: clutches and brakes	2
- Clutches	
- Brakes	
11.Connecting elements	4
- Tread standards and definitions	
- Preload and looseness-proof	
- Force analysis	
- Bolt strength	
12.Other elements and review	2

Laboratories and Laboratory Hours:

1. Belt drive	2
2. Shaft assembly	2
3. Sliding bearing	2

<u>Grading:</u>

Homework	15%
Discussions and presentations	15%
Inclass Quizzes	10%
Lab performance	10%
Final	50%

<u>Text & Reference Book:</u>

1. Robert L. Norton. Machine design, an integrated approach. Fourth Edition. ISBN: 0-13-612370-8, Upper Saddle River: Pearson Education Inc., 2010.
2. Shigley, Joseph, Charles Mischke, and Richard Budynas. Mechanical Engineering Design. Boston, MA: McGraw-Hill, 2003. ISBN: 9780072921939

101037308 Machine Design Project

Lecture Hours: 3
Laboratory Hours: 2 weeks
Credits: 2
Prerequisite(s): 101037307

Course Description:

This is an advanced project-based course in design and integration. It also serves as a best practice for students to learn the way in which machine elements such as bearings, gears, shaft, bolts, cams and mechanisms are used. Modelling and analysis of these elements is based upon extensive application of core mechanical engineering principles. These principles are reinforced through a substantial design project wherein students model, design, fabricate and characterize a mechanical system that is relevant to a real-world application. The main goal of this term project is to practice the knowledge from the prerequisites mainly including the courses such as principle of machine and machine design, and to help students to successfully tackle genuine engineering problems encountered in practice.

Course Outcomes:

After completing this project, the student should be able to:

1. Practice the knowledge from the prerequisites mainly including the courses such as principle of machine and machine design
2. Master the complete design process of simple mechanical systems
3. Be familiar with usage of mechanical design handbook
4. Know well mechanism synthesis, kinematic and dynamic analysis
5. Know well the design process of typical mechanical elements.
6. Know well the application of tolerances limits and fits
7. Help students to successfully tackle genuine engineering problems encountered in practice

Course Content:

The project is to create a structure from a concept. The typical mechanical device may be a reducer, but is not limited to it. One lecture will be given to describe the project task, project process and so on, then the students will do the project independently under the guidance of the instructor. Students are required to fulfil the following design tasks in due time

1. Mechanism synthesis;
2. Kinematic and dynamic analysis;
3. Designing or selecting the gears, shafts, and bearing, etc., with detailed analysis;
4. Assemble designed components with reasonable considerations;
5. Give reasonable dimensions and tolerances limits and fits in assembly drawing and part drawings;
6. Complete engineering drawing including assembly and part drawings;
7. Design report.

Laboratories and Laboratory Hours:

1. Reducer assembly	2

Grading:

On-time step due	10%
Structure design, drawing	50%
Design analysis	20%
Report writing	20%

101037309 Heat Transfer

Lecture Hours: 28
Laboratory Hours: 4
Credits: 2
Prerequisite(s): 101180111, 101180121, 100172103 and 100172203

Course Description:

Heat transfer is a basic science that deals with the rate of transfer of thermal energy. The objectives of this course are to cover the basic principles of heat transfer, which include heat conduction, transient heat conduction, heat convection, convection differential equations, forced convection and free convection, thermal radiation, the Stefan-Boltzmann law, projection radiation and effective radiation, the view factor, the grey surface, enhancement heat transfer and heat exchangers. By learning this course, students should acquire the basic theoretical knowledge of heat transfer law and corresponding calculation methods and skills.

Course Outcomes:

After completing this course, a student should be able to:

1. Understand a series of basic concepts and the macro research methods of heat transfer, having the preliminary ability of making heat transfer models.
2. Learn the basic principles and main ways of heat transfer.
3. Master three basic processes of heat transfer and the basic method of calculation heat transfer.

Course Content:

Lectures and Lecture Hours:

1. Introduction of Heat Transfer 2
   - The Research Object, Task and Basic Research Method of The Heat Transfer
   - Heat Transfer Mode
   - Heat Transfer Process
   - The Energy Conservation of Control Volume and Control Surface
   - The Engineering Application of Heat Transfer
2. Heat conduction rationale 2
   - Thermal heat flow rate equation for Heat Conduction
   - Thermal Properties of Materials
   - Differential Heat Conduction Equations and Single-valued Condition
3. Steady heat conduction 3
   - One-Dimensional Steady Heat Conduction
   - The Heat Transfer of Extended Surface
   - Multi-Dimensional Steady Heat Conduction
4. Transient heat conduction 3
   - Characteristics of Transient Heat Conduction
   - Analytical Solution of One-Dimensional Heat Conduction Within Convection Boundary Conditions
   - Analysis Method of Concentrated Parameter
   - Two-Dimensional and Three-Dimensional Transient Heat Conduction
5. Principle of Convection 4
   - Summarize of Convection
   - Differential Convection Equations
   - Boundary Layer and Differential Heat Transfer Equations of The Boundary Layer
   - Analogies between Momentum and Heat Transfer
   - Similarity Theory and The Application In Solving Problems of Convection
6. Normalized formulas of single-phase fluid and convective heat transfer 4
   - Forced Convection In Tubes
   - External Forces Convection
   - Natural convection

7. Fundamentals of thermal radiation 2
   - Essence and Characteristics of Thermal Radiation
   - Radiation Intensity and Radiometric Force
   - Blackbody Radiation
   - The Stefan-Boltzmann Low
   - Actual Object Radiation
   - Kirchhoff's Low
8. Calculating of thermal radiation 4
   - Projection Radiation and Effective Radiation
   - The View Factor
   - Computational Method of The View Factor
   - Computation of Radiation Heat Transfer
   - Multimode heat transfer
   - The gray surface
9. Enhancement heat transfer and heat exchangers 4
   - Heat Transfer Equation
   - Compound Heat Transfer
   - Enhancement and Reduction of The Heat Transfer
   - Heat Exchanger types
   - Calculating of Heat Exchangers

Laboratories and Laboratory Hours:

1. Measure of Fluid Conduction Coefficient 2
   - Learn and master the method to measure the conduction coefficient by this experiment
   - Analyse the problem by Fourier's Law, discuss and present a testing plan
   - Calculate, analyse and discuss the result of the experiment, ascertain the relationship between conduction coefficient and temperature, give an analysis of the test error
2. Measure of Convection Coefficient 2
   - Learn the experimental research method of convection, use the similarity criterion to organize data and realize the importance similarity theory to convection.
   - According to the equipment provided, give several experiment plans and implementation, finish experiment by one way.
   - Measure the convection coefficient in the condition that air flows through single pipe horizontal surface, and then organize data to criterion equation.

Grading:

Prerequisite quiz	3%
Homework	10%
In class Quizzes	5%
Group Presentation	5%
2 Midterm Exams	40%
Project	15%
Final	17%
Instructor Evaluation	5%

Text & Reference Book:

1. Frank P. Incropera and David P. DeWitt, Fundamentals of Heat and Mass Transfer, John Wiley and Sons, 5th edition, 2002. ISBN 0-471-38650-2.
2. Jack Holman. Heat Transfer. McGraw-Hill, 10th edition, January 13, 2009.

101037310 Mechanical Vibrations

Lecture Hours: 36
Laboratory Hours: 12
Credits: 3
Prerequisite(s): 102172501

Course Description:

This course is to explore general theory of free, forced, and transient vibrations; vibration transmission, isolation, and measurement; normal modes and generalized coordinates; method of matrix equation formulation and solution. The application of theory and methods to the analysis, measurement and design of dynamic systems will also be introduced in the course.

Course Outcomes:

After completing this course, a student should be able to:

1. Model real and physical dynamic systems in terms of mathematical models.
2. Apply principles of mechanical vibrations such as Newton's second law, and the principle of conservation of energy to the mathematical models to obtain their governing equations of motion.
3. Solve the obtained equations of motion to understand behaviour of oscillatory systems to various excitations such as harmonic excitation, and impulse excitation.
4. Develop basic numerical simulation skills using MATLAB to simulate the dynamic and oscillatory response of physical models.

Course Contents:

Lectures and Lecture Hours:

1. Introduction of Mechanical Vibrations	2
2. Vibration of one DOF systems	6
-Free vibrations (undamped and viscously damped)	
-Forced vibrations (undamped and viscously damped)	
3. General excitations	6
-Impulse excitation	
-Response spectra	
-Direct integration methods	
4. Two DOF systems	4
-Free vibrations (undamped and viscously damped)	
-Forced vibrations (undamped and viscously damped)	
5. General MDOF systems	8
-Stiffness, flexibility and mass matrices	
-Natural frequencies and mode shapes (eigenvalues and eigenvectors)	
-Modal analysis and introduction to finite element analysis	
-Energy methods	
-Lagrange's equations	
6. Vibration of continuous systems and wave propagation	6
-Analysis of vibration of continuous system	
-Wave propagation	
7. Mechanical vibrations problems in industry	4

Laboratories and Laboratory Hours:

1. Free vibration test of one DOF system (undamped and viscously damped)	2
2. Forced vibration test of one DOF system	2
3. Testing of Eigenvalues and eigenvectors of a MDOF system	2
4. Testing of active and passive vibrating isolations	2
5. Modal testing of a beam system	2
6. Modal testing of a real engineering structure (ICE component)	2

Grading:

Homework	10%
Laboratory performance	15%
In class Quizzes	5%
Midterm Exams	25%
Final Exams	40%
Instructor Evaluation	5%

Text & Reference Book:

1. Michel Geradin , Daniel J. Rixen, Mechanical Vibrations: Theory and Application to Structural Dynamics 3rd Edition, 2015, ISBN-13: 978-1118900208.
2. A.A. Shabana, Theory of Vibration: An Introduction (Mechanical Engineering Series) (Vol 1) 2nd Edition, 1995, ISBN-13: 978-0387945248.
3. D. E. Newland, An Introduction to Random Vibrations, Spectral & Wavelet Analysis: Third Edition (Dover Civil and Mechanical Engineering) 3rd Edition, 2005, ISBN-13: 978-0486442747.

101037311 Modelling and Simulation of System

Lecture Hours: 40
Laboratory Hours: 8
Credits: 3
Prerequisite(s): 100172103, 100172203, 102172501, 101180111, 101180121, 101013001, 101051238, 101051239

Course Description:

This course is designed as an introductory undergraduate course in modelling and simulation of dynamic systems. It consists of MATLAB application-based modelling, and control-oriented simulation of dynamic systems. Some fundamental physical rules and engineering methods will be applied to model the typical dynamic systems. Frequency domain-based analysis for dynamic systems will be introduced. Feedback controller will be designed and analysed at the end of the lecture. This course will help the undergraduates to be capable of modelling and simulating variables and typical dynamic systems by using Matlab/Simulink software and enhance their understanding and usage of the numeric algorithm and solver for dynamic systems. The attendees will also build the model-based design methodology and familiarize with some tools and platforms.

Course Outcomes:

Students will enhance the concept of system dynamics and obtain the thorough understanding of typical dynamics process and their characters. They will be equipped with the knowledge and application capability for system modelling, simulation and analysis. After completing this course, a student should be able to:

1. Develop mathematical models of dynamic systems using transfer functions and state-space formulation.
2. Learn the typical models for mechanical system and mechatronic system.
3. Analyse frequency response of dynamic systems, such as stabilities, bandwidth, and sensitivities.
4. Analyse time response of dynamic systems, such as speed of response, overshoot, steady-state errors.
5. Use Matlab/Simulink to analyse and simulate system properties.

Course Content:

Lectures and Lecture Hours:

1. Introduction to system dynamics	2
2. Solution methods for dynamic models -Differential equations -Laplace transform and transfer function -Examples and discussion	6
3. Spring and damper elements in mechanical systems -Spring element and spring-mass system -Damping element and additional modeling examples	4
4.State-variable models and simulation method -State-variable models and solution -Simulink and linear models -Simulink and non-linear models	6
5. Electric and electromechanical systems -Electric modeling and impedance method -Electric motors -Modeling applications	6
6. System analysis in the frequency domain -Frequency response of first order system -Frequency response of high order system	8

-Frequency response examples
-filter property and system identification

7. Transient response and block diagram models 8
-Response of first order system
-Response of second order system
-Step response
-Block diagram-

Laboratories and Laboratory Hours:

1. DC motor system modelling and simulation, 4
DC motor modelling and simulation; test data-based Parameter estimation; response experiment. (After chapter 5)
2. Mass-spring-damper mechanical system, 4
Free vibration measurements and comparisons with responses predicted from modelling and calibration. (After chapter 7)

Grading:

Evaluation

7 Homework;
Final test;
Discussions and presentations;
2 Labs.

Final Grade Percentages

Homework:	30%
Performance in class：	10%
Lab performance:	20%
Final test:	40%

Text & Reference Book:

Textbook

William J. Palm. System Dynamics. McGraw-Hill, 2nd Edition, 2010

Recommended References

Katsuhiko Ogata. System Dynamics. Prentice Hall, 2003.

101037312 Chinese Culture and Cross-Cultural Communications

Lecture Hours: 16
Laboratory Hours: 0
Credits: 1
Prerequisite(s): None

Course Description:
Globalization is one of the major forces shaping our world, and communicating across cultures is a crucial skill for students in the international networks of business, science, and technology. This course is designed to help students establish cultural identity of their own, understand the role of communication in culture and the major cultures in the world, recognize cultural variables and their influences on communication in a diverse world. This course provides students with knowledge and effective skills that help them become sensitive to cultural differences and interact successfully with people from different cultures. This course is taught in English. Students can learn the subjects by lectures, case studies, readings and assignments. The course is conducted as a seminar/workshop. Students are encouraged to participate in discussion, exercises, and presentations. They have variety of opportunities to practice cross-cultural communication by themselves.

Course Outcomes:
There are five objectives to accomplish in this course:
1. To understand Chinese culture and its characteristics in communication.
2. To learn about the cultural characteristics and communication behaviours of other cultures.
3. To learn about communication norms, rituals, taboos of other cultures, and the ethical issues in communicating interculturally.
4. To learn about the practical skills in cross-cultural communication.
5. To practice performing intercultural communication.

Course Content:
Lectures and Lecture Hours:

1.Introduction to course	2
2.Culture and communications	2
3.Cultural Patterning and Variability	2
4.Introduction to major cultures	4
5.Intercultural Interaction and communication	2
6.Practice of communication with other cultures	2
7.Intercultural communication in different processional settings.	2

Grading:

Individual Assignment	30%
Team Presentation	20%
Team report	30%
Class participation	15%
Instructor Evaluation	5%

Text & Reference Book:
Samovar, Larry A., and Richard E. Porter. Communication Between Cultures. 5th ed. Belmont, CA: Wadsworth Publishing Co., 2003. ISBN: 0534569307.

101037313 Basic Training of Manufacturing Technology

Lecture Hours: 10
Laboratory Hours: 50
Credits: 2
Prerequisite(s): 101037302

Course Description:

This course is to explore mechanical manufacturing technologies through lectures and basic trainings. Most of the modern manufacturing methods and typical machine tools will be introduced and used during the course. Basic equipment operating skills will be trained.

Course Outcomes:

After completing this course, a student should be able to:

1. Understand principles of modern manufacturing techniques;
2. Be familiar with applications of typical manufacturing equipment.
3. Select appropriate manufacturing methods and processes.
4. Operate typical equipment to produce normal mechanical parts.

Course Contents:

Lectures and Lecture Hours:

1.Introduction	1
- Metal casting	
- Forging	
- Welding	
2.Metal casting process forming methods and applications	1
- Precision casting	
- Foundry molding drawing	
- Applications of material methods	
3.Introduction of machining methods	1
- Turning	
- Milling	
- Grinding	
- Drilling	
4.Cutting tool materials	1
- High speed steel	
- Cemented carbide	
- Others	
5.Principles of milling	1
- Motions	
- Parameters	
- Process	
6.Gear profile machining	1
7.Benchwork	1
- Assembling	
- Tool making	
8.Hole making	1
- Drilling	
- Boring	
- Grinding	
9.Introduction of NC (Numerical control) machining	1
- NC turning	
- NC milling	
10.Rapid prototyping & manufacturing	1

Laboratories and Laboratory Hours:

1. Basic training of metal casting training;	10
2. Basic training of turning;	10
3. Basic training of milling;	10
4. Basic training of bench work;	10
5. Basic training of NC machining;	5
6. Basic training of 3D printing;	5

Grading:

Homework	10%
Project	90%

Text & Reference Book:

1. Manufacturing Engineering and Technology. Serope Kalpakjian, Steven Schmid. Prentice Hall, 6th Revised edition (2009-3)，ISBN 0136081681

101037314 Embedded Control System Design

Lecture Hours: 20
Laboratory Hours: 12
Credit: 2
Prerequisite: 101080081C

Course Description:
This course is designed as an introductory undergraduate course in embedded control system. Students will learn basic knowledge of a microprocessor, and several basic applications of microprocessor like I/O, interrupt, PWM, and some advanced applications like driving a 1602 LCD, using PWM and H bridge to drive an electric motor. Students will learn the courses as well as doing exercise on a learning board, they will write code to realize every function, and finally, they will do a more complicated project to control a robot electric vehicle to trace a black line on the ground. So, students can well understand what a microprocessor can do and how to use them in industrial applications.

Course Outcomes
Students will learn the basic use of PIC microprocessors I/O, USART, interrupt, drive a LCD, PWM, etc. And then students will build a 2-motor driven robotic vehicle, and use PIC microprocessors to control the robot to trace a black line on the floor.

Course Content
Lectures and Lecture Hours:
1. Course introduction. Embedded C programming and the PIC16 processor.
2. Introduction to DC motors; Motor control interfacing; Present lecture material on optical encoders; LCD interface
3. Microprocessor interrupt system; Priority and vectors; Input capture and output compare; Lowe power design and wake up
4. A/D conversion, sampling and aliasing; simple anti-aliasing filter design
5. Discuss motor control (speed control, torque control, power amplifiers); Pulse width modulation;
6. Data acquisition systems; Accuracy, resolution, precision; Transducers; Digital control systems; Open loop control; Closed loop control; PID control

Lab works (12 hours)

Lab	Topic	Assignments
Lab 1	Familiarization and Digital I/O, oscilloscope, signal generator, etc. Light the LEDs. (2 hours)	Light the LEDs in a required pattern.
Lab 2	Interrupts, Timing, and Frequency Analysis (2 hours)	Use time interrupts to control the interval of the LEDs.
Lab 3	Analog-To-Digital Conversion (2 hours)	Use ADC module to get the potentiometer signal.
Lab 4	Pulse Width Modulation (PWM) (2 hours)	Use PWM module to control the motor speed
Lab 5	Microprocessor based control system implementation of a simple robotic vehicle (4 hours)	Microprocessor based control system implementation of a simple robotic vehicle

Grading:
5 Labs.
Final test;

Final Grade Percentages

Performance in class：	10%
Lab performance:	60 %
Final test:	30 %

Text & Reference Book:

Textbook:

N. Natarajan. Embedded Systems: A hands-on Approach. 2013

Recommended References

Asdasdsa, Dogan Ibrahim. Advanced PIC Microcontroller Projects in C, Newnes, 2011

101037315 Principle of Control and Instrumentation

Lecture Hours: 40
Laboratory Hours: 8
Credits: 3
Prerequisite(s): 101037311

Course Description:

This course is an introduction of control and measurement systems to undergraduate students in mechanical engineering. It involves the fields of control engineering and measurement techniques. The main objective is to learn basic control and measuring theory, and understand classical control techniques and sensor applications, and possess the ability of building control and measuring systems. This course covers measurement transducers, structure of measuring system, signal conditioning, measurements of motion and force, mathematical models of mechanical system, state variable models, performance and stability of linear feedback systems, frequency response methods, and digital control techniques.

Course Outcomes:

After completing this course, a student should be able to:

1. Understand the control theory and measurement techniques including classical and modern control methods, and the design, application and implementation of measuring systems.
2. Apply the measurement knowledge to precision metrology and control system, and analyse error source.
3. Have progressive development of problem-solving skills.

Course Content:

Lectures and Lecture Hours:

1.Introduction to Measurement and Instrumentation 2
- Introduction
- Significance of Measurement and Instrumentation
- Measuring Systems
- Units and Standards

2.Transducers 4
- Physical Law
- Static Characteristics
- Transducer Types and Modelling
- Calibration
- Errors in Measurements
- Uncertainty Analysis

3.Structure of Measuring System 4
- Method of Measurement
- Comparison of Method of Measurements
- Interaction Between Components
- Bridge Circuits
- Basic Transducer Circuit
- System with Feedback
- Methods of Noise Reduction
- Noise Documentation

4.Nonself-Generation Transducers and Applications 4
- Differential Transformers
- Differential Transformers: Applications
- Carrier Systems
- Inductive Transducers
- Inductive Transducers: Applications
- Strain Gages

- Strain Gages: Applications
- Capacitive Transducers
- Capacitive Transducers: Applications

5.Signal Conditioning and Output Devices 5

- Operational Amplifiers: Characteristics
- Operational Amplifiers: Basic Circuits
- Op-Amp Amplifiers and Applications
- Binary Numbering Systems
- Digital Techniques
- Functional Logic Circuits

6.Displacement, Motion, Force, Torque, and Pressure Measurements 5

- Dimensional and Displacement Measurements
- Motion Measurements
- Velocity Measurements
- Acceleration Measurements
- Force Measurements
- Torque Measurements
- Pressure Measurements

7.Introduction to Control Systems 1

- Introduction
- Examples of Control Systems
- Closed-Loop Control Versus Open-Loop Control
- Design of Control Systems

8.Mathematical Models of Systems 3

- Introduction
- Transfer Function
- Automatic Control Systems
- Modelling in State Space
- State-Space Representation of Differential Equation Systems
- Linearization of Nonlinear Mathematical Models

9.Transient and Steady-State Response Analyses 2

- Introduction
- First-Order Systems
- Second-Order Systems
- Routh's Stability Criterion
- Steady-State Errors in Unity-Feedback Control Systems

10.Control Systems Analysis and Design by the Root-Locus Method 3

- Introduction
- Root-Locus Plots
- Root-Locus Approach to Control Systems Design
- Lead Compensation
- Lag Compensation
- Lag-Lead Compensation

11.Control Systems Analysis and Design by the Frequency-Response Method 2

- Introduction
- Bode Diagrams
- Nyquist Stability Criterion
- Relative Stability Analysis
- Control Systems Design by Frequency Response Approach

12.PID Controllers and Modified PID 2

- Introduction
- Ziegler-Nichols Rules for Tuning PID Controllers
- Modifications of PID Control Schemes

13.Digital Control Systems 3

- Introduction
- Sampled-Data Systems

- z-Transform
- Closed-Loop Feedback Sampled-Data Systems
- Implementation of Digital Controllers
- Sequential design example: disk drive read system

Laboratories and Laboratory Hours: 8

1. Studying Transient Response Characteristics by Changing Parameters of the Plant
2. Frequency Response and Log Magnitude Plot
3. Digital PID Controller
4. External Disturbance Rejection

Grading:

Homework	20%
Project	20%
Final	60%

Text & Reference Book:

1. Francis S. TSE, Ivan E. Morse, Measurement and Instrumentation in Engineering: principles and basic laboratory experiments. ISBN 0-8247-8086-8.
2. Katsuhiko Ogata, Modern Control Engineering, Fifth Edition, ISBN 978-7-121-12203-3.

101037316 Fluid Mechanics

Lecture Hours: **40**
Laboratory Hours: **8**
Credits: **3**
Prerequisite(s): 100172103, 100172203, 101013001, 101014001, 101037306

Course Description:
Fluid Mechanics is the study of the motion of fluids, and the forces that arise within fluids and on surfaces in contact with a fluid. An understanding of the basic principles and concepts of fluid mechanics is essential to the analysis of any system in which a fluid (gas or liquid) is involved as the working medium. Students will study fluids at rest and in motion for internal and external flows. The course is designed to help students develop meaningful and connected knowledge of main concepts and equations as well as develop the skills and approaches that work effectively in professional practice.

Course Outcomes:
After completing this course, a student should be able to:
1. Identify or predict the flow regime in a given engineering system based on consideration of the governing non-dimensional groups.
2. Calculate the hydrostatic forces and moments on planar and curved submerged surfaces.
3. Construct an appropriate (fixed, deforming, or moving) control volume for a given engineering system and apply the principles of conservation of mass, momentum, and energy to this control volume.
4. Decide when appropriate to use ideal flow concepts and the Bernoulli equation.
5. Present data or governing equations in non-dimensional form, design experiments, and perform model studies.
6. Solve internal flow in pipes and channels through simple solutions, the Moody chart, and the head-loss equation.
7. Solve external flow, evaluate lift and drag, and know when there is possibility of flow separation.
8. Understand fluid measurement methods.

Course Content:
Lectures and Lecture Hours:

1	Introduction and Fluid Properties -Liquids and Gases. -The Continuum Assumption. -Dimensions, Units, and Resources. -Applications and Connections. -Fluid Properties	2
2	Fluid Statics - Pressure - Pressure measurements - Forces on Plane Areas - Forces on Curved Surfaces	4
3	Flowing Fluids and Pressure Variation - Descriptions of Fluid Motion - Acceleration - Euler's Equation - The Bernoulli Equation Along a Streamline - Cavitation	4
4	Control Volume Approach and Continuity Equation - Basic Control Volume Approach	2

	- Continuity Equation	
5	Momentum Equation, Applications – Examples	2
	- Momentum Equation	
	- Applications – Examples	
6	Energy Equation	4
	- Energy Equation	
	- Applications – Examples	
	-summary	
7	Dimensional Analysis and Similitude	4
	- Buckingham π Theorem	
	- Similitude	
	- Model Studies for Flows	
	- Model-Prototype Performance	
8	Surface Resistance	4
	- Surface Resistance with Uniform Laminar Flow	
	- Qualitative Description of the Boundary Layer	
	- Laminar Boundary Layers	
	- Boundary Layer Transition	
	- Turbulent Boundary Layers	
9	Flow in Conduits	6
	- Classifying Flow	
	- Pipe Head Loss	
	- Stress Distributions in Pipe Flow	
	- Laminar Flow in a Round Tube	
	- Turbulent Flow and the Moody Diagram	
	- Solving Turbulent Flow Problems	
	- Combined Head Loss	
10	Drag and Lift	2
	- Relating Lift and Drag to Stress Distributions	
	- Calculating Drag Force	
	- Vortex Shedding	
	- Lift and Drag on Airfoils	
	- Lift and Drag on Road Vehicles	
11	Compressible Flow	6
	- Wave Propagation in Compressible Fluids	
	- Mach Number Relationships	
	- Normal Shock Waves	
	- Isentropic Compressible Flow Through a Duct with Varying Area	

Laboratories and Laboratory Hours:

1. Fluid Statics	1
2. Bernoulli Equation	2
3. Momentum Equation	2
4. Renold Experiment	1
5. Pipe Flow	2

Grading:

Inclass Quizzes	5%
Homework	15%
MidTerm Exam	15%
Final Exam	35%
Instructor Evaluation	5%
Laboratory	25%

Text & Reference Book:

Textbook

B.R. Munson, D.F. Young, T.H. Okiishi. Engineering Fluid Mechanics, 9th ed., 2009, ISBN-13:

978-0470-25977-1.

Recommended References

1. Frank. M. White. Fluid Mechanics,7th ed., 2011, ISBN 978-0-07-352934-9.
2. Young, Donald F., Bruce R. Munson, and Theodore H. Okiish. A Brief Introduction to Fluid Mechanics, 5th ed., 2011, ISBN-13: 978-0470-59679-1.

101037317 Manufacturing and Machine Tools

Lecture Hours: **52**
Laboratory Hours: **14**
Credits: **4**
Prerequisite(s): **101037305, 101037304, 101037307, 101037315**

Course Description:

This course provides comprehensive knowledge and insight into various aspects of manufacturing processes, tooling, and equipment. Its main objective is to introduce a wide array of manufacturing technology to students who are involved in the design and manufacturing of finished products, to provide them with the basic information on manufacturing technologies. The course focuses on fundamentals of manufacturing processes and equipment used to convert raw materials to a final product. It presents diverse manufacturing processes, including casting, bulk deformation, sheet-metal forming, material removal, processing of polymers/plastics and rapid prototyping, processing of metal-powders/ceramics/composites/ superconductors, joining and fastening, fabrication of microelectronic and micromechanical devices, surface technology, and computer-age manufacturing. Students are also introduced to the functions performed by a variety of machine tools employed by the modern manufacturing community. In addition, numerical control and industrial robots are covered. Product quality control, automation in manufacturing, health, safety, and environmental aspects in manufacturing are also discussed.

Course Outcomes:

After completing this course, a student should be able to:

1. Demonstrate a basic understanding of manufacturing processes for engineering materials. This course serves as a guideline for the understanding of available manufacturing processes used in industry today. Topics covered include casting, bulk deforming, sheet-metal forming, material removal processes, polymers / plastics/composites processing, joining and fastening, microelectronic and micromechanical devices fabricating, surface technology, and computer-age manufacturing. Students are also introduced to the functions performed by a variety of machine tools employed by the modern manufacturing community.
2. Demonstrate the ability to select appropriate methods for manufacturing a part in line with the specifications and to calculate machining related speed, feed and metal removal rates.
3. Demonstrate an understanding of the role of economic considerations in manufacturing process selection and optimization, as well as the ability to optimize manufacturing process based on cost and period of production.
4. Recognize the significance of manufacturing as it supports the economy of a country and benefits its people.

Course Content:

Lectures and Lecture Hours:

1.Introduction to manufacturing technology	2
2.Metal-Casting Processes and Equipment	4
- Fundamentals of metal-casting	
- Metal-casting processes and equipment	
- Metal-casting: design, materials, and economics	
3.Forming and Shaping Processes and Equipment-Rolling	14
- Metal-rolling processes and equipment	
- Metal-forging processes and equipment	
- Metal-extrusion and drawing processes and equipment	
- Sheet-metal forming processes and equipment	
- Powder-metal processes and equipment	
- Plastics and composite materials: forming and shaping	
- Additive manufacturing	
4.Machining Processes and Machining Tools	14

- Fundamentals of machining
- Cutting-tool
- Turning
- Milling, broaching, and gear manufacturing
- Machine tools
- Abrasive & finishing operations
- Advanced machining processes

5.Micro-manufacturing and Fabrication of Microelectronic Devices 4

- Fabrication of microelectronic devices
- Fabrication of MEM-devices and nanoscale manufacturing

6.Joining Processes and Equipment 4

- Fusion welding processes
- Adhesive-bonding and mechanical-fastening
- Advances in automotive welding

7.Surface Technology and Metrology 6

- Surface roughness
- Metrology and tolerance
- Coating

8.Manufacturing in a Competitive Environment 4

- Automation of manufacturing processes
- CAM-CIM
- Sustainable and environment-friendly manufacturing

Laboratories and Laboratory Hours:

1. Die forming processes of micro-optical glass lens 2
2. Meso-machining processes of miniatured impellers. 2
3. High-precision 6-axis coupled grinding processes of micro-drilling/milling tools. 2
4. Measurement of machining process variables 6
5. 3-coordinate measuring machine and the measurement of part accuracy 2

Grading:

Homework	15%
Discussions and in class performance	15%
Lab performance	20%
Test 2	20%
Final Exam	30%

Text & Reference Book (optional A or B):

1. A1. Serope Kalpakjian, Steven R. Schmid, Hamidon Musa. Manufacturing Engineering and Technology: Hot Processe. （制造工程与技术: 热加工 英文版•原书第 6 版). ISBN 9787111363064. 北京：机械工业出版社, 2012 年 1 月
2. A2. Serope Kalpakjian 和 Steven R. Schmid. Manufacturing Engineering and Technology: Machining.（制造工程与技术:机加工 英文版•原书第 6 版). (美). ISBN 9787111363057. 北京：机械工业出版社, 2012 年 1 月.
3. B. Serope Kalpakjian, Steven R. Schmid. Manufacturing Engineering and Technology, 6th Edition. ISBN 978-0136081685. Prentice Hall, April 2009.

101037318 Internal Combustion Engine Fundamentals

Lecture Hours: 54
Laboratory Hours: 10
Credits: 4
Prerequisite(s): 101037316, 101037306, 101037309

Course Description:
This course is intended to discuss the basic operation of internal combustion engines (ICE). It will focus more on the primary concepts, principles. Some detailed structures of internal combustion engine will also be mentioned. Contents include the fundamentals of most common types of internal combustion engines, with emphasis on reciprocating engines. Both spark ignition and compression ignition engines are covered, operating on four-stroke and two-stroke cycles. Main topics include fluid flow, thermodynamics, combustion, heat transfer and friction phenomena, and fuel properties relevant to engine power, efficiency, and emissions.

Course Outcomes:
After completing this course, a student should be able to:
1. Hold the basic concepts and characteristics of ICE;
2. Be familiar with the working principle and structure of ICE and familiar with the sub-systems of ICE;
3. Understand the basic properties of the fuels (Gasoline, Diesel and some potential alternative fuels) and combustion cycle of ICE.
4. Be familiar with the working principle of emission control, heat transfer and lubrication of ICE.

Course Content:
Lectures and Lecture Hours:

1. Introduction	4
2. Operating Characteristics	6
3. Engine Cycles	4
4. Thermochemistry and Fuel	4
5. Air and Fuel Induction	4
6. Fluid Motion within Combustion Chamber	6
7. Combustion	8
8. Exhaust Flow	4
9. Emissions and Air Pollution	4
10. Heat Transfer and Cooling System	4
11. Friction and Lubrication	4
12. Review Q&A	2

Laboratories and Laboratory Hours:

1.On-spot engine basic structure study	2
2.Computer class on engine work diagram and parameters calculation	2
3.Workshop: Engine new technology	4
4.Engine performance experiment	2

Grading:

Instructor Evaluation	5%
Project	5%
Lab reports	20%
Final	70%

Text & Reference Book:
Willard W. Pulkrabek, Engineering Fundamentals of the Internal Combustion Engine (2nd Edition), Prentice-Hall, 2004. ISBN 0-13-140570-5.

101037319 Automobile Structure and Design

Lecture Hours: 48
Laboratory Hours: 16
Credits: 4
Prerequisite(s): 101051238, 101051239,101037304, 101037311, 101037315

Course Description:
This course is to explore the specialized knowledge related to the automobile structure and design from a professional engineering viewpoint. The course is the application and upgrade of applied knowledge learned in previous core courses. Its main objective is to introduce both general and key aspects of automobile performances involved in the design process. This course focuses on various driving performances of the automobile from the dynamics point of view. It presents fundamentals of automobile design process, including the overall basic structure and key parts, the performance and evaluating indexes, tire and aerodynamic, equation of ride motion, vibration and suspension, steering and stability, and electronic control and safety. Students are also introduced to the development of modern automobile and world motor industry.

Course Outcomes:
After completing this course, a student should be able to:
1. Understand the overall basic structure and key parts, including engine, transmission and driving system, steering and braking system.
2. Analyse automobile longitudinal driving performance using equation of ride motion.
3. Analyse automobile steering and stability performance using equations of handling dynamics.
4. Analyse automobile ride comfort performance using equations of vertical dynamics.
5. Understand the basic principle of automobile electronic control system, such as how to ease of control and how to make the car more safety.
6. Select the proper parameters of automobile keys parts from the ride performance point of view.

Course Content:
Lectures and Lecture Hours:

1	The introduction and overview	2
2	The overall basic structure and key parts of automobile	2
3	The performance and evaluating indexes of automobile	2
4	The structure, characteristics and resistance and torque of tire	4
5	Longitudinal straight-line motion -D-f -Driving performance with MT -Driving performance with AT -Driving performance with EV -Multi-wheel drive	10
6	Braking Process, Braking system and Braking force distribution -Braking process and braking system -Braking force distribution (multi-wheel drive)	4
7	Suspension, International Standard ISO:26	2
8	Automobile ride models	6
9	Steering Geometry -Steering Geometry and steady-state handling characteristics -Steady-state handling characteristics and steady-state response to steering input -Steady-state response to steering input -Directional stability	10
10	Automobile Electronic Control and Safety	6

- Principle, function, composition
-Sensor, ECU, Control bus
-Automatic Transmission Control System

Laboratories and Laboratory Hours:

1.	Case study1:	Driveline assembling and clutch assembling	3
2.	HW1:	Set up Longitudinal straight motion equation	
3.	Case study2:	Longitudinal straight motion modelling	3
4.	Test 1:	Braking test with ABS	2
5.	HW2:	Set up ride dynamics equation	
6.	Test 2:	Active and Semi-active suspension	2
7.	HW 3:	Steering motion modelling	
8.	Case study3:	Directional handling stability modelling	3
9.	Case Study4:	Automobile electronic system design	3

Grading:

Homework:	12%
Discussions and presentations:	10%
Case study performance:	20%
Tests 1-2:	8%
Mid-Quiz	15%
Final test:	35%

Text & Reference Book:

Textbook

1. Reza N. Jazar. Vehicle Dynamics: Theory and Application, ISBN: 978-0-387-74243-4, e-ISBN: 978-0-387-74244-1 Springer, 2009.

Recommended References

1. 汽车工程学（I、II、III）（英文版），Automobile Engineering(I, II,III)，机械工业出版社，2009
2. 汽车理论，余志生主编，机械工业出版社 2011.
3. 汽车工程手册，日本自动车技术会编，中国汽车工程学会 译 北京理工大学出版社，2010
4. Heinz Heisler. Advanced Vehicle Design. Reed Educational and Professional Publishing Ltd 2001. Electronic version
5. Julian Happian-Smith. An Introduction to Modern Vehicle Design. ISBN 07506 5044 3 Reed Educational and Professional Publishing Ltd 2002.

101037320 Engineering Management

Lecture Hours: **36**
Laboratory Hours: **12**
Credits: **3**
Prerequisite(s): **100172103, 100172203, 102172401**

Course Description:

Over the past several decades, engineering work has been becoming more and more complex and understanding and applying business principles to engineering have never been more important. This course is designed for students to get the knowledge and skills required to manage engineering projects and organizations within the company efficiently and productively, which covers the fields of fundamentals of management, project management and engineering economic. The topics of this course include introduction to engineering management, the manager, organization and team, uncertainties and probabilities, engineering evaluation and selection, planning, budgeting, scheduling, resource levelling and allocations, multiple engineering project management, engineering monitoring and controlling, engineering evaluation and termination. A lot of examples are provided to students to practice by their own in laboratories hours. The practice is supervised by instructors. A complete case which includes six parts will be analysed and presented by student groups in the course.

Course Outcomes:

After completing this course, a student should have:
1. The ability to apply knowledge of project management and engineering economic into analysis of complex engineering management problem.
2. The ability to conduct engineering management experiments, as well as to analyse and interpret engineering data.
3. The ability to function on engineering management multidisciplinary teams.
4. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
5. The ability to use the techniques, skills, and modern engineering tools necessary for engineering management practice.

Course Content:

Lectures and Lecture Hours:

1.Introduction 2
- Introduction to engineering management

2.The manager, organization and team 2
- Roles and skills for manager and team
- Engineering project organization
- Project management organizations and certifications

3.Uncertainties and Probabilities in engineering management 2
- Monte Carlo method
- Crystal Ball
- Uncertainties simulation and probabilities analysis

4.Engineering Evaluation and Selection 2
- Non-financial evaluation method
- Financial evaluation method

5.Engineering planning 6
- Engineering project charter
- Planning processes
- Work breakdown structure
- Mind map
- Risk management

6.Engineering budging 4

- Introduction of time and cost estimating
- Cost estimating
- Improving cost estimates
- Budget uncertainty and risk simulation

7.Engineering scheduling	6
- Critical path method	
- Gantt Chart	
- Program Evaluation and Review Technique	
- Simulation	
8.Resource leveling and allocations	4
- Resource management	
- Expediting an engineering project	
- Resource loading and leveling	
- Allocating scarce resources to projects	
9.Multiple engineering project management	2
- Project portfolio management	
- Project portfolio selection methods	
10.Engineering monitoring and controlling	4
- Plan-monitor-control cycle	
- Data collecting and reporting	
- Earned Value analysis	
- Engineering project control	
11.Engineering Evaluation and Termination	2
- Evaluation	
- Engineering auditing	
- Engineering termination	

Laboratories and Laboratory Hours:

1. Crystal Ball and uncertainties simulation	2
2. Cost estimation and time value	2
3. Engineering projects and tasks defining	2
4. Engineering scheduling	1
5. Engineering resources leveling and allocation	2
6. Multiple Engineering project management	1
7. Engineering tracking and forecasting	2

Grading:

In-class Quizzes	5%
Assignments	10%
Case Study and Group Presentation	25%
Final	60%

Text & Reference Book:

Textbook

1. Jack R. Meredith, Scott M. Shafer, Samuel J. Mantel, Jr., Margaret M. Sutton, Project Management in Practice, 5th ed., Wiley, 2014, ISBN 978-1-118-67466-6

Reference Books:

2. William G. Sullivan, Elin M. Wicks, C. Patrick Koelling, Engineering Economy, 16th ed., Prentice Hall, 2014 ISBN 978-0-133-43927-4
3. David R. Anderson, Dennis J. Sweeney，Thomas A. Williams, Statistics for Business and Economics 12th ed., Cengage Learning, 2014, ISBN 978-1-305-26433-5
4. Marcello Spagnulo, Rick Fleeter, Mauro Balduccini, Federico Nasini, Space Program Management--Method and Tools, Springer, 2013, ISBN 978-1-4614-3755-0

101037321 Engineering Design Project

Lecture Hours: 8
Laboratory Hours: 3 weeks
Credits: 3
Prerequisite(s): 101037302, 101037305, 101037307, 101037323

Course Description:
This course is a design project course in Mechanical Engineering. It is designed for senior students to practice their knowledge, skills and abilities they have developed in previous courses, to design a mechanical device, components, process or manufacturing system to satisfy a real need with the goal of synthesizing the technical, environmental, economic, and social issues. The students in this course will be working in teams following a design process for developing a product. Design needs from industry clients or partners are provided to students. After getting approved by instructor, students can also work on their own proposed project. The design projects are supervised. There are lectures about design process and important issues of product development. Project team reports and oral presentations are required in the end of the course. This course can help students be more experienced in engineering design and be better prepared to take on professional responsibilities after they graduate. The minimum duration of this course is three weeks.

Course Outcomes:
Upon completion of this course, the student should be able to:
1. Design an industrially-relevant complex and integrated mechanical system, individual components, manufacturing process or manufacturing facility or system.
2. Identify needs, and develop design constraints and specifications for a real-world engineering project.
3. Apply the engineering design process to design.
4. Select proper material and suitable manufacturing methods for the proposed design.
5. Consider important design issues including safety, cost, manufacturability, environmental, sustainability, and ethical concerns in design and development.
6. Work in group, cooperate with multi-discipline engineers, and effectively communicate the design and production process
7. Use modern engineering design tools to design, analyse, and simulate product, and process.
8. Use engineering standards and references, search patents in design.
9. Understand intellectual property, plan and apply for intellectual properties.
10. Present and communicate the design results.

Course Content:
Lectures and Lecture Hours:
Lectures are given by instructor or invited guests from industry or customers. The topics may vary each year. The scope of these topics may include:
1. Product design and development process
2. Understanding mechanical design
3. Identification of needs and specifications
4. Engineering design methodology
5. Concepts generation and selection
6. Manufacturability considerations in design
7. Prototyping
8. Engineering design and analysis tools
9. Intellectual property
10. Communication and project planning

Laboratories and Laboratory Hours:
Students registered in this course can use computer room, design lab, manufacturing lab for product modelling, analysis and simulation, prototype construction.

Design reviews by supervisors are conducted during laboratory hours.

Grading:

Student will be graded on both the overall result of group project, and the individual contribution and performance in design process. The group project will be evaluated in terms of innovation of design, the feasibility of solution, quality of design, writing of report, prototype modelling, presentation, project management etc. The individual performance is evaluated on contribution to the project, report, presentation, attendance and participation in the project.

Group Project	60%
Quality of Design	
Group Report Writing	
Oral Presentation	
Individual	40%
Individual contribution	
Individual report writing	
Presentation	
Attendance and participation	

Text & Reference Book:

1. Karl Ulrich and Steven Eppinger, Product Design and Development, Fifth Edition, McGraw-Hill 2012
2. David Ullman, The Mechanical Design Process, Fourth Edition, McGraw-Hill Higher Education, 2010.

101037322 Energy System and Design

Lecture Hours: 40
Laboratory Hours: 8
Credits: 3
Prerequisite(s): 101037306, 101037309

Course Description

The structure and technologies of energy systems of the world are changing rapidly. Part of it is because of three reasons: the mitigation of climate change; the rapid depletion of fossil fuels; the reduction of energy consumption so as to maintain a sustainable development. Renewable energies such as biomass, solar etc. have been vastly used, even in developing countries like China.

This course aims to help students identify the major questions in the area of energy resources and energy technologies, and learn how to develop concrete schemes to tackle problems concerned. The course commences with an overview of the main source of carbon emissions, energy production, followed by discussions of different scenarios for an energy mix. Such energy mix relies heavily on the deployment of renewable energy technologies such as biomass, geothermal, hydroelectric, solar, tidal, wave and wind. The scientific and technical foundations of these technologies are examined in order to assess their ultimate potential as well as their practical limitations. As the key contents of the course, fundamental theories and design methods of energy systems using the renewable energies mentioned above are introduced.

Course Outcomes

At the end of the course it is expected that students are able to:

1. Identify and use reliable sources of information on energy, and develop their own knowledge and understanding using recently published information.
2. Describe and quantify the major factors affecting the potential contribution to the world's needs of the various sources of energy, such as available resource, status of technical development, and economic aspects.
3. Understanding of conventional and sustainable energy production and utilization, explain the scientific basis of the energy technologies studied, and use that understanding in calculating the contribution an energy source can make in given circumstances.
4. Develop a personal well-argued and quantified view of a possible energy future.

Course Content

Lectures and Lecture Hours:

1. Introduction 2
   - Overview of energy sources
   - Relationship between energy, population and wealth
   - Pressures facing world due to energy consumption
   - Units of measure used in energy systems
2. Systems tools for energy systems 4
   - Existing energy resources and the concept of sustainable development
   - Fundamental of the system approach
   - Tools applied to energy or energy systems
3. Economic tools for energy systems 2
   - Overview and introduction
   - Economic analysis of energy project and systems
   - Direct versus external costs and benefits
   - Intervention in energy investments to achieve social aims
4. Fossil fuel resources 2
   - Overview and introduction
   - Decline of conventional fossil fuel and a possible transition to nonconventional alternatives

5. Stationary combustion systems 6
   - Overview and introduction
   - Fundamentals of combustion cycle calculation
   - Advanced combustion cycles for maximum efficiency
   - Economic analysis of investments in high-efficiency combustion systems
   - Incorporating environmental considerations into combustion project analysis
   - Fossil fuel combustion in the future
   - Systems issues in combustion in future
6. Carbon sequestration 4
   - Overview and introduction
   - Indirect sequestration
   - Geological storage of CO2
   - Sequestration through conversion of CO2 into inert materials
   - Direct removal of CO2 from atmosphere for sequestration
   - Overall comparison of sequestration options
7. The utilization of solar resource 6
   - Overview of solar resource
   - Solar photovoltaic technologies
   - Design and operation of practical photovoltaic systems
   - Active solar heating systems
   - Passive solar heating systems
8. Wind energy systems 4
   - Overview and introduction
   - Using wind data to evaluate potential locations
   - Turbine design
   - Economics of wind power

9 Transportation energy technologies 4
   - Overview and introduction
   - Vehicle design considerations and alternative propulsion design
   - Alternative to ICEVs: alternative fuels and propulsion platform

10 Concepts of Combined Heat Power systems 4
   - Introductions
   - Concepts of combined heat power systems
   - Design of combined heat power systems

11 Energy system facing future 2
   - Overview and introductions
   - Pathways to a sustainable energy future: case study

Laboratories and Laboratory Hours:

1: Energy transferring efficiency testing of a solar energy gathering system 4

2: Assembly and testing of energy transferring distribution of a small CHP system 4

Grading:

Major project	50%
On-line discussion forum	20%
Assignments, quizzes and lab performance	30%

Text& Reference Book:

1. Godfrey Boyle. Renewable energy: power for a sustainable future. Oxford University Press, 2004
2. John Andrews and Nick Jelley, Energy Science: Principles, Technologies, and Impacts, Oxford University Press, 2007.

101037323 Graduation Project (Thesis)

Credits: **12**
Prerequisite(s):

Course Description:

Graduation Project (Thesis) is required in the Mechanical Engineering Program for students who aim to receive a Bachelor's degree in Mechanical Engineering. The course provides training for students to be able to work independently on design or research project within the field of mechanical engineering. The student should plan, carry out and report on the project under the supervision of one faculty instructor. The design or research results should be submitted. The dissertation should be submitted based on the student's work in accordance with established academic standards within the stated time frame and budget for resources. The oral defence is required to report the results and finding in thesis.

During the work of the Graduation Project (Thesis), students are required to complete the following tasks:

- Proposal report on research or design topic
- Information searching and literature review report
- Translation of referencing paper
- Mid-term evaluation report
- Weekly report
- Other deliverables depend on topics, such as engineering drawings, experiment plans, product models and analysis reports etc.
- Thesis and oral defence

Grading:

Instructor's evaluation:	30%
Review by faculty member:	30%
Oral defence:	40%

101037324 Engineering Design Practice

Lecture Hours: 8
Laboratory Hours: 2 weeks
Credits: 2
Prerequisite(s): 101037302

Course Description:
The main purpose of this course is to let students be familiar with engineering design process, design representation, and cooperation in team-work. Students will be working in a group, working on a design project given by instructor or proposed by students themselves, to exercise the ability of problem solving, fundamental mechanical design and design representation in 2D drawings and 3D objects. It's a practice course following the course Engineering Graphics. Students need to manage the design project by themselves including definition of specifications, design parameters, task assignment, project management, means of communication and cooperation. Each project will result in design report, formal representation by engineering drawings, as well as other necessary technical documents.

Course Outcomes:
After taking this course, students will:
1. Understand the generic design process in mechanical engineering.
2. Be familiar with typical engineering design problems in mechanical engineering.
3. Demonstrate a strong ability in using mechanical design tool and making formal standard working drawing with modelling software.
4. Be familiar with document organization, technical report writing and presentation.
5. Be able to work in a team, and have the ability of organization, communication, cooperation in team work.
6. Gain problem-solving and communication skills in team project design.

Course Content:
Lectures and Lecture Hours:
1. Introduction to generic design process in mechanical engineering
2. Understanding mechanical design
3. Planning of design and team management
4. Custom needs and engineering specifications
5. Concept and product generation
6. Design representation in CAD
7. Consideration of design constraints in economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
8. Reporting and presentation
9. Seminar and final design presentation

Grading:
The contribution and performance of each member is reviewed by team leader and other team members. The individual final score is evaluated by instructor according to the result of each design project, presentation, and deliverables.

Contribution as a member to the group	20%
Final report and technical documents of the group	30%
Group Presentation	30%
Final project results and report	15%
Instructor Evaluation	5%

Text & Reference Book:
David G. Ullman. The Mechanical Design Process, Fourth Edition. ISBN: 0072975741. McGraw Hill Higher Education, 2009,
Cecil Jensen. JAY. Engineering Drawing & Design, 7th Edition. ISBN 978-0073521510 McGraw-Hill Higher Education, 2008

101037325 Computer-Aided Design and Engineering

Lecture Hours: 48
Laboratory Hours: 0
Credits: 3
Prerequisite(s): 101037302 101037305 101037307 101037325

Course Description

This course covers the basic knowledge of principles, techniques and applications of computer-aided technologies in product design, analysis, and manufacturing. During this course, students can learn the fundamental principles, theories, and applications of current technologies in computer-aided design (CAD), computer-aided engineering (CAE), and computer-aided manufacturing (CAM). Students can gain the ability of applying the technologies in product design and development environment, and students will be more equipped and confident to solve difficult problems in design and manufacturing.

Course Outcomes

After successfully completing this course, students should be able to:

1. Understand the product design and development process and the applications of computer technologies in each stage, including system engineering, design and analysis, process planning, manufacturing, inspection and verification, product delivery and recycle.
2. Understand the general representation, and manipulation algorithms of geometric entities including curves, surfaces, and solid, and the techniques of transformation of geometric entities using transformation matrix.
3. Apply product modelling techniques in design, including feature-based modelling, parametric design, dimensioning and tolerancing annotation, assembly modelling, kinematic design and analysis.
4. Analyse mechanical part strength, stress, and deformation with CAE tools.
5. Apply optimization algorithm to optimize product design parameters with math tool.
6. Understand the concept and theory of design and manufacturing integration and concurrent engineering.
7. Describe key concepts in CNC machining and part programming, apply geometric operations for toolpath generation, define key parameters for cutter location definition, and create programming codes to produce typical tool paths for machining operations.
8. Understand the general concepts and principles of product data management.

Course Content

Lectures and Lecture Hours:

Part I Introduction to Product Development 4
1. Introduction to product development process
2. Computer technologies in product design and development

Part II Computer-aided Design 16
3. Geometric modelling of curves and surfaces
4. Geometric Transformations
5. Solid modelling techniques and feature-based design
6. Assembly modelling and analysis

Part III Computer-Aided Engineering 12
7. Motion Analysis
8. Structural Analysis using FEA
9. Design Optimization

Part IV Computer-Aided Manufacturing 12
10. Integration of product design and manufacturing
11. NC Part Programming and Machining Simulation
12. Toolpath Generation

Part V Product Lifecycle Management 4

13. Product data management
14. Standard of data exchange

Lab works:

These lab works can be done by students in their spare time, by registering lab hours in the computer lab. No laboratory hours will be arranged in class. The topics and requirements of lab works are given in assignments. Students should complete the following works in CAD tool, in this course, PTC CREO Parametric is suggested and used in teaching.

1. Product design with CAD tools
2. Strength analysis of mechanical part
3. Optimization with math tools
4. CNC part programming and simulation

Group Project:

Design of a mechanical device will be done by students working in groups. The maximum number of students in each group is 4. A mechanical device or product is selected by students. The complexity of the design is required. Modelling, performance analysis and simulation, and NC programming should be finished by students. Students should complete the following design tasks:

- Proposal and presentation of the design project. The selected product should have at least 10 components. There are parts having complex geometry and surfaces. Motions and workload should be involved in product. Each group should present the project in class, explaining the shape and structure, specifications, parameters, working conditions, performances, and manufacturing process etc.
- Modelling of product. Students should complete the part modelling, parametric modelling, assembly modelling, mechanism modelling.
- Analysis of design. The performances of design have to be analysed and simulated. The motion analysis, structure analysis, thermal analysis, design sensitivity analysis, optimizations in CAD/CAE tools are required.
- NC part programming. Generate toolpath of selected component, and simulate NC machining process in CAM tools.
- Writing of group and individual design report. The final design will be presented in class.
- Submission of all models, documents, and reports in the course website.

<u>Grading</u>

Homework and Lab	30%
Project	30%
Final Exam	40%

<u>Text & Reference Book</u>

1. Kuang-Hua Chang, Product Design Modelling using CAD/CAE, Elsevier, 2014
2. Kuang-Hua Chang, Product Manufacturing and Cost Estimating using CAD/CAE, Elsevier, 2014

101051238 Electrical & Electronics I

Lecture Hours: 40
Laboratory Hours: 0
Credits: 2.5
Prerequisite(s): 100172103, 100172203, 101180111 and 101180121

Course Description:
This an introductory course of electrical and electronics for engineering students whose major is not electrical or electronics. The course introduces the fundamental theory and experimental skills of basic circuit analysis and measurement, including circuit elements, Kirchholf's Law, resistive circuits, inductance and capacitance, transients, etc. The steady-state sinusoidal analysis, frequency response and resonance are discussed. Diodes, amplifiers, and bipolar junction transistor are also taught with introduction of industrial applications.

Course Outcomes:
After completing this course, a student should be able to:
1. Develop theoretical and experimental skills and experiences in basic circuit analysis and measurement, first-order transient, steady-state ac circuits analysis, diode circuits, electronic amplifiers and operational amplifiers.
2. Analyse AC and DC circuits and determine the theoretical value for current, voltage, power and resistance (impedance) in ac and dc series and parallels circuits applying Ohm's law, Kirchholf's voltage and current laws, Thevenin equivalent method.
3. Analyse and design basic diode, transistor and operational amplifier circuits.
4. Apply basic electronics to industrial applications.

Course Content:
Lectures and Lecture Hours:

1.Introduction	4
Circuits, Currents, and Voltages	
Power and Energy	
Kirchholf's Laws	
Introduction to Circuit Elements	
Introduction to Circuits	
2.Resistive Circuit	8
Resistance in series and parallel	
Network analysis by using series and parallel equivalents	
Voltage-divider and current-divider circuits	
Node-voltage analysis	
Thevenin and Norton equivalent circuits	
Superposition principle	
3.Inductance and Capacitance	1
Capacitance	
Physical characteristics of capacitance	
Inductance	
Practical inductance	
4.Transients	4
First-order RC circuits	
DC steady state	
RL circuit	
5.Steady-state sinusoidal analysis	6
Sinusoidal Currents and Voltages	
Phasors	
Complex Impedances	
Circuit Analysis with Phasors and Complex Impedances	

Power in AC Circuits
Balanced Three-Phase Circuits

6.Frequency response and resonance	2
Fourier Analysis, Filters, and Transfer Functions	
First-Order Lowpass/Highpass Filters	
Series Resonance	
Parallel Resonance	
7.Diodes	3
Basic Diode Concepts	
Load-Line Analysis of Diode Circuits	
Zener-Diode Model	
Rectifier Circuits	
Wave-Shaping Circuits	
8.Amplifiers: specifications and external characteristics	2
Basic Amplifier Concepts	
Power Supplies and Efficiency	
Additional Amplifier Models	
Ideal Amplifier	
Frequency Response	
Linear Waveform Distortion	
Differential Amplifier	
9.Bipolar junction transistors	4
Current and Voltage Relationships	
Common-Emitter Characteristics	
Load-Line Analysis of Common-Emitter Amplifier	
PNP Bipolar Junction Transistors	
Small-Signal Equivalent Circuits	
Common-Emitter Amplifier	
Emitter Followers	
10.Operational amplifiers	6
Ideal Operational Amplifiers	
Inverting Amplifiers	
Noninverting Amplifiers	
Design of Simple Amplifiers	
Op-amp Imperfections in the Linear Range of Operation	
Nonlinear Limitations	
DC Imperfections	
Differential and Instrumentation Amplifiers	
Integrators and Differentiators	
Active Filters	

Laboratories and Laboratory Hours:
Refer to 101051295 'Experiment for Electrical & Electronics(I)'

Grading:

Homework	15%
Project	10%
Final	70%
Instructor Evaluation	5%

Text & Reference Book:
Allan R. Hambley, Electrical Engineering: Principles and Applications, 6th ed., 2014, ISBN 978-0-13-311664-9

101051239 Electrical & Electronics II

Lecture Hours: **40**
Laboratory Hours: 0
Credits: **2.5**
Prerequisite(s): **100172103, 100172203, 101180111 and 101180121**

Course Description:
This the second part of introductory course of electrical and electronics for non-electrical or electronics majored engineering students. This course covers various topics on digital circuit analysis, electromechanical engineering and electrical controlling. Students will learn to conduct analysis of basic combinational and sequential logic circuit, basic AC motor design, and to apply circuit to industrial applications.

Course Outcomes:
After completing this course, a student should be able to:
1. Develop theoretical and experimental skills and experiences in digital circuit analysis, electromechanical engineering and electrical controlling.
2. Analyse basic combinational and sequential logic circuit.
3. Analyse and understand basic ac motor design.
4. Apply basic controlling circuit to industrial applications.

Course Content:
Lectures and Lecture Hours:

1.Logic Circuits	16
-Basic Logical Circuits Concepts	
-Representation of Numerical Data in Binary Form	
-Combinatorial Logic Circuits	
-Synthesis of Logic Circuits	
-Minimization of Logic Circuits	
-Sequential Logic Circuits	
2.Magnetic Circuits and Transformers	6
-Magnetic Fields	
-Magnetic Circuits	
-Inductance and Mutual Inductance	
-Magnetic Materials	
-Ideal Transformers	
-Real Transformers	
3.AC Machines	6
-Three-Phase Induction Motors	
-Equivalent-Circuit and Performance Calculations for Induction	
-Synchronous Machines	
-Single-Phase Motors	
-Stepper Motors and Brushless DC Motors	
4.Motor Electrical Control	6
-Low-voltage Apparatus	
-Introduction to the Typical Control Principles & Circuits	
-Introduction to the General Design Principles	
5.The Basic Principles and Applications of PLC	6
-Introduction	
-The Basic Framework and Operating principles	
-Data Types and Addressing modes of S7-200 CPU	
-Basic Instructions of S7-200	
-Application Examples	

Laboratories and Laboratory Hours:

Mechanical Engineering
Refer to 101051296 ‘Experiment for Electrical & Electronics(II)’

Grading:

Homework	15%
Project	10%
Final	70%
Instructor Evaluation	5%

Text & Reference Book:
Allan R. Hambley, Electrical Engineering: Principles and Applications, 6th ed., 2014, ISBN 978-0-13-311664-9

101051295 Experiment for Electrical & Electronics I

Lecture Hours: 0
Laboratory Hours: 16
Credits: 0.5
Prerequisite(s): 100172103, 100172203, 101180111 and 101180121

Course Description:

This the experimental course supplementing the course 101051238 Electrical & Electronics(I). In this course, students will do 8 experiments in electrical measurement, RLC circuits, AC circuits, amplifier, and the applications of op-amp.

Course Outcomes:

After completing this course, a student should be able to:

1. Develop theoretical and experimental skills and experiences in basic circuit analysis and measurement, first-order transient, steady-state ac circuits analysis, diode circuits, electronic amplifiers and operational amplifiers.
2. Analyse AC and DC circuits and determine the theoretical value for current, voltage, power and resistance (impedance) in ac and dc series and parallels circuits applying Ohm's law, Kirchholf's voltage and current laws, Thevenin equivalent method.
3. Analyse and design basic diode, transistor and operational amplifier circuits.
4. Apply basic electronics to industrial applications.

Course Content:

Laboratories and Laboratory Hours:

1.Electrical measurement	2
2.Research on RLC circuits	2
3.Research on RC circuit's transient response	2
4.Single-phase AC circuits and power factor improvement	2
5.Research on three-phase AC circuits	2
6.Research on single-stage amplifier	2
7.The basic applications of op-amp (1)	2
8.The basic applications of op-amp (2)	2

Grading:

Attendance	25%
Skills	25%
Final	45%
Instructor Evaluation	5%

Text & Reference Book:

Allan R. Hambley, Electrical Engineering: Principles and Applications, 6th ed., 2014, ISBN 978-0-13-311664-9

101051296 Experiment for Electrical & Electronics II

Lecture Hours: 0
Laboratory Hours: 16
Credits: 0.5
Prerequisite(s): 100172103, 100172203, 101180111 and 101180121

Course Description:
This the experimental course supplementing the course 101051239 Electrical & Electronics(II). In this course, students will do 8 experiments in rectifier, filter and voltage regulator circuit, combination and sequential logic circuits, application of transformer, Relay-contactor control systems, and S7-200 PLC.

Course Outcomes:
After completing this course, a student should be able to:
1. Develop theoretical and experimental skills and experiences in digital circuit analysis, electromechanical engineering and electrical controlling.
2. Analyse and troubleshoot the basic combinational and sequential logic circuit
3. Analyse and understand basic ac motor design.
4. Apply basic controlling circuit to industrial applications.

Course Content:
Lab works and Lab Hours:

1.Research on the rectifier, filter and voltage regulator circuit	2
2.The design of combination logic circuits	2
3.The design of sequential logic circuits	2
4.The application of transformer	2
5.Relay-conactor control systems (1)	2
6.Relay-contactor control systems (2)	2
7.S7-200 PLC basic experiment (1)	2
8.S7-200 PLC basic experiment (2)	2

Grading:

Attendance	25%
Skills	25%
Lab report	45%
Instructor Evaluation5%	

Text & Reference Book:
Allan R. Hambley, Electrical Engineering: Principles and Applications, 6th ed., 2014, ISBN 978-0-13-311664-9

Electronics Engineering

Educational Objectives

Electronics Engineering program enables students to use engineering principles, tools, and technologies to identify and solve engineering problems in the field of electronics engineering. Electronics Engineers are involved in the analysis, design and production of radio, radar, television, computing, telecommunication, control and information systems. Students will be able to find solutions to the challenging technical problems that arise in our rapidly changing society, such as wireless communications, audio and video equipment, power distribution, computerized traffic control, noise pollution monitoring, and medical instrumentation.

Core Course

Calculus, Physics, Linear Algebra, Probability and Statistics, Engineering Graphics, Introduction to Electronics and Information Engineering, Computer Science and Programming, Fundamental Circuit Analysis, Signals and Systems, Fundamental Analog Circuits, Digital Circuits, Electromagnetic Theory and Microwave Engineering, Digital Signal Processing, Telecommunication Circuits, Semiconductor Physics and Device Modeling, Principle of Digital Communication, Computer Principle and Applications, Fundamental Control Theory, Data Communication and Networking, Integrated Circuit Engineering, Electronic Communication Systems, Engineering Innovation Design (series I – VII), Engineering Management, Final Project.

Program Outcomes

The graduates of Electronics Engineering program will have the ability to apply knowledge of mathematics, science and engineering to develop a desired electronic system under the constraints of economy, environment, society, health, safety, manufacturability and sustainability. The graduates will be able to work in multidisciplinary team with effective communication, management, and leadership skills. The graduates will have knowledge of the latest techniques, skills, and modern engineering tools to model, analyze, design and realize electronic system and components. Graduates are qualified to work in electronics and information industries.

Duration and Degree

4 years, Bachelors of Engineering in Electronics Engineering (or Electronic Science and Technology)

Curriculum

Semester 1			Credits
100245105	国际英语交流 I	International English Communication I	2
100172103	工科数学分析 I	Mathematical Analysis for Engineering I	6
102172501	线性代数 A（双语）	Linear Algebra A	3.5
101190003	大学化学 C（全英文）	General Chemistry C	2
101080081	计算机科学与编程（英文）	Computer Science and Programming	3
100270001	思想道德修养与法律基础	Ideological and Moral Cultivation and Basics of Law	3
100230057	知识产权法基础	Introduction to Intellectual Property Law	1
100930001	大学生心理素质发展	Psychological Quality Development of College Students	0
100160501	生命科学基础 A	Principle of Life Science A	2
100050201	信息与电子专业导论	Specialized Introduction to Information and Electronics	0
101051272	电子系统体验与工艺实践（全英文）	Technique Practice of Electronic Systems	1
107050207	工程创新设计 I	Engineering Innovation Design I	0.5
100320001	体育 I	Physical Education I	0.5
100980001	军事理论	Military Theory	1
100980002	军事训练	Military Training	1.5
Total Hours			**27**

Semester 2			Credits
100245106	国际英语交流 II	International English Communication II	2
100172203	工科数学分析 II	Mathematical Analysis for Engineering II	6
101180111	大学物理 I（全英文）	College Physics I	4
100180116	物理实验 B I	Physics Laboratory B I	1
101031102	工程制图基础（全英文）	Engineering Graphics Fundamental	2
100270002	中国近代史纲要	The History of Modern China	2
100172001	复变函数与积分变换	Complex Variables and Integral Transform	2
101053205	算法与数据结构（全英文）	Algorithm and Data Structure	1.5
101053272	计算机与网络实验 I（全英文）	Light Level Labwork of Computer and Network I	0.25
101051203	电路分析基础（全英文）	Fundamentals of Circuit Analysis	3
101051278	电路与电子线路实验 I（全英文）	Light Level Labwork of Circuit and Electronic Circuits I	1
107050208	工程创新设计 II	Engineering Innovation Design II	0.5
100320002	体育 II	Physical Education II	0.5
101080082	C 语言编程实践（全英文）	C Programming Practice	1
100270006	形势与政策	Situation and Policy	2
Total Hours			**28.75**

Semester 3			Credits
101180121	大学物理Ⅱ（全英文）	College Physics II	4
100180125	物理实验 BⅡ	Physics Laboratory B Ⅱ	1
100172003	概率论与数理统计	Probability Theory and Mathematical Statistics	3
100270003	马克思主义基本原理概论	Introduction to Basic Principles of Marxism	3
101052203	信号与系统（全英文）	Signals and Systems	3
101052272	信号与信息处理实验 Ⅰ（全英文）	Light Level Labwork of Signal and Information Processing I	0.5
101051206	模拟电路基础（全英文）	Fundamentals of Analog Circuits	3
101051280	电路与电子线路实验Ⅱ（全英文）	Light Level Labwork of Circuit and Electronic Circuits II	0.75
101051274	电子实习Ⅰ（全英文）	Electronic Labwork I	1
101051276	电子实习Ⅱ（全英文）	Electronic Labwork II	1
100050202	认知实习	Cognitive Practice	1
101050204	工程概论（全英文）	Introduction to Engineering	1
104210001	管理学概论	Introduction to Management	1
107050309	工程创新设计III	Engineering Innovation Design Ⅲ	1
100320003	体育III	Physical Education III	0.5
Total Hours			24.75

Semester 4			Credits
100270004	毛泽东思想和中国特色社会主义理论体系概论	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics	4
101051209	数字电路（全英文）	Digital Circuits	3
101051282	电路与电子线路实验III（全英文）	Light Level Labwork of Circuit and Electronic Circuits III	1
101054203	电磁场理论与微波工程（全英文）	Electromagnetic Field Theory and Microwave Engineering	4
101054272	电磁场理论与微波工程实验（全英文）	Electromagnetic Field Theory and Microwave Engineering	0.5
101052206	数字信号处理（全英文）	Digital Signal Processing	2.5
101052274	信号与信息处理实验Ⅱ（全英文）	Light Level Labwork of Signal and Information Processing Ⅱ	0.25
101051312	通信电路（全英文）	Communication Circuits	3
101051384	电路与电子线路实验Ⅳ（全英文）	Light Level Labwork of Circuit and Electronic Circuits IV	0.5
101056303	半导体物理与器件建模（全英文）	Semiconductor Physics and Device Modeling	3
104210004	经济学概论Ⅰ	Essentials of Economics I	1
107050310	工程创新设计Ⅳ	Engineering Innovation Design IV	1
100320004	体育Ⅳ	Physical Education IV	0.5
100050114	素质拓展	Quality Development	4
Total Hours			**28.25**

Semester 5			Credits
101051386	电路与电子线路课程设计（全英文）	Labwork of Circuit and Electronic Circuits	2
101053376	计算机与网络课程设计（全英文）	Labwork of Computer and Networks	1
101052377	信号与信息处理课程设计（全英文）	Labwork of Signal and Information Processing	0.75
101054375	电磁场与微波课程设计（全英文）	Labwork of Electromagnetic Field and Microwave	1
101057303	数字通信原理（全英文）	Digital Communication Principles	3
101057372	数字通信原理实验（全英文）	Light Level Labwork of Digital Communication Principles	0.25
101053308	计算机原理与应用（全英文）	Computer Principle and Application	4
101053374	计算机与网络实验Ⅱ（全英文）	Light Level Labwork of Computer and Networks II	1
101055303	控制理论基础（全英文）	Fundamentals of Control Theory	2
101055372	控制理论基础实验（全英文）	Light Level Labworks of Fundamentals of Control Theory	0.25
101058406	数据通信与网络（全英文）	Data Communication and Networks	2
101037303	科学研究与写作（英文）	Research Methods and Academic Writing	1
107050411	工程创新设计Ⅴ	Engineering Innovation Design V	1
100270005	社会实践	Social Practice	2
Total Hours			**21.25**

Semester 6			Credits
101056408	集成电路工程（全英文）	Integrated Circuits Engineering	4.25
101057410	电子通信系统（全英文）	Electronic Communication Systems	4
107050412	工程创新设计Ⅵ	Engineering Innovation Design VI	1
100031314	制造技术基础训练	Basic Training of Manufacturing Technology	2
101056474	嵌入式系统设计与验证	Embedded System Design and Verification	2
Total Hours			**13.25**

Semester 7			Credits
100056473	毕业实习	Specialized Practice	3
100050416	创新创业实践 B	Practice of Innovation and Entrepreneurship B	4
Elective	文化素质类通识教育课专项	General Education	6
Elective	实践训练通识课专项	Lab Electives	2
Total Hours			**15**

Semester 8			Credits
100050413	毕业设计（论文）	Graduation Design (Thesis)	12
Total Hours			**12**
Total Credit Hours			**170.25**

Course Descriptions

101051203 Fundamentals of Circuit Analysis

Fundamentals of Circuits Analysis is an important academic foundation for all information and electrical specialties. It mainly introduces the basic concepts, basic theories, and basic analysis methods of the circuits, especially linear circuits. The course systematically introduces electric circuit model, Kirchhoff's law, circuit theorems, and equivalent transformation of circuit model, basic analytical method of linear resistance electric circuit, the ideal operational amplifier circuit, the transient analysis of first-order circuits, the transient analysis of second-order circuits, the steady-state analysis of sinusoidal circuit, calculation of three-phase circuit, the analysis of circuit with mutual inductance, calculation of non-sinusoidal current circuit.

Prerequisites: College Physics, Higher Mathematics

101051206 Fundamentals of Analog Circuits

This course will explore the electronic devices and the analog electronic circuits. It covers semiconductor pn junction and transistors, small and large signal amplifiers, feedback amplifier analysis, frequency response of BJT and FET amplifiers, and frequency response with feedback stability, operational amplifier circuitry and applications.

Prerequisite(s): Fundamentals of Electric Circuit Analysis

101051209 Digital Circuits

The course includes the following chapters: fundamentals of digital circuits, transistor fundamentals, number system, Boolean algebra, Karnaugh maps, logic gates, arithmetic circuits, flip-flops, counters, registers, memory and finite state machine. The students need to preview the related topic before each class. Homework will be assigned according to each chapter. There are 5 quizzes during the whole semester; There is one final project and you can work in groups (max. 2 in each group). Grading will be based on the project report and PowerPoint presentation. Late submission will result in a ZERO.

Prerequisite(s): Fundamentals of Electric Circuit Analysis, Fundamentals of Analog Circuits

101051272 Technique Practice of Electronic Systems

It is a basic course of experiment, which is suitable for electronic information specialty. Before the study of specialized basic courses, the students can get the following basic knowledge and abilities from this course: (1) have an initial understanding of the composition of electronic systems, which include signal reception, signal processing and signal output; (2) master the methods of identification and measurement of electronics components which include Resistor, capacitor, inductance, diode, and transistor etc.; (3) master the test and measurement methods of common instrument, including digital multimeter and digital oscilloscope; (4) master welding technology; (5) training the identify and design ability of primary circuit diagram; (6) training the measurement and debugging ability of primary circuit; (7) know about the working principle of the 555 timer and the basic working principle of black and white television.

101051274 Electronic Labwork I

Through the theoretical teaching, students will understand the concepts of digital audio, digital video, coding and decoding, embedded system, digital product, grasp the working principle of MP3 main controlling chip. Furthermore, students will understand the principle diagram of the MP3 digital player, and can analyze the fault causes of MP3 digital player according to the principle diagram. Through the lab work, the students will have practical knowledge on electronic components, electronic materials and the production process of electronic products, so as to get the general knowledge of electronics technology. At the same time, the students will understand the reflow soldering technology, and master manual welding skills.

Prerequisite(s): Fundamentals of Circuit Analysis

101051276 Electronic Labwork II

The students will know about the wireless communication history; be familiar with the generation and propagation principle of electromagnetic wave, the characteristics of electromagnetic wave transmission and the principle of receiving and emitting; the circuit and working principle of PJ - 80 type radio direction-finding receiver; master how to receive signal and how to identify the radio call sign; understand the principle of functional direction finder module, which includes high frequency amplification circuit, diode mixer circuit, oscillation circuit, audio amplification and power amplification circuit. Welding, debugging and measurement and the actual direction finding on the PJ-80 direction finder circuit will be carried on in the class.

101051278 Light Level Labwork of Circuit and Electronic Circuits I

This course is one of the most important experiment courses of Electrical Specialty in colleges and universities. Students are required to grasp the necessary basic knowledge of circuit analysis when learning this course. The primary content includes analysis of electromagnetic phenomena in the circuit, exploring and verifying the basic laws as well as the design and analysis methods of electric circuit. The students will build up scientific thinking and develop capacity of experimental research and scientific induction, establish a rigorous scientific attitude and engineering viewpoint of applying theory to reality.

Prerequisite(s): Mathematical Analysis for Engineering

101051280 Light Level Labwork of Circuit and Electronic Circuits II

This course is to implement analog circuit using transistors or operational amplifiers; design an analog amplifier for specific applications; analyze the relation between the characters of an amplifier; analyze and design a rectifier and voltage regulator. Electrical measurement devices will be extensively used in the class.

Prerequisite(s): Fundamentals of Analog Circuits

101051282 Light Level Labwork of Circuit and Electronic Circuits III

The course includes two parts: the hardware design and software design of digital circuits. There are three experiments for the hardware design: the first one is to learn about the logic function of gates, such as NAND gates, NOR gates, XOR gates, etc.; the second one is the design and test of integrated counters, and the third one is the application of commonly used CMOS integrated

circuits. After the three laboratory, students should master the method to test the logic function of gates and commonly used circuits, be familiar with the usage of test equipment and integrated chips. In the software design parts, the students will complete the design of the simple convolution, a complete testbench is also required to test the design. The digital circuit fundamentals is required in this class. The basic Verilog HDL language and the ModelSim simulator are essential for the software design experiments. The students need to preview the related topic before the laboratory.
Experiments should be finished during the class. After finishing the design and test of the circuit, the solderless breadboard should be checked and a report should be submitted. Grading will be based on when and how the design is finished, and the quality of the report.

Prerequisite(s): Fundamental of Circuit Analysis, Fundamentals of Digital Circuits design, Fundamentals of circuit simulators

101051312 Communication Circuits
This course covers the analysis of nonlinear circuit in analog communication system; the basic principle and design of Single-tuner resonant power amplifier circuit, sine oscillator, AM modulation and demodulation circuit, FM modulation and demodulation circuit, PM modulation and demodulation circuit, mixer circuit, Phase-locked loop circuit, and the design of analog communication system.

Prerequisite(s): Fundamentals of Electric Circuit, Analysis Fundamentals of Analog Circuits, Signals and Systems

101051384 Light Level Labwork of Circuit and Electronic Circuits IV
This course will research on the unit module of nonlinear circuit in analog communication system by analyzing Colpitts oscillators, amplitude modulation and demodulation, mixer, phase detector, and phase-locked loops. Study is based on experiment boxes using measurement equipment.

Prerequisite(s): Communication Circuit

101051386 Labwork of Circuit and Electronic Circuits
The content of this course is to design and implement two digital-analog mixed system: 1. Design an infrared remote-control emitter/receiver, which includes: the encoder and decoder, the modulator and demodulator, and the display; 2. Design a digital thermometer with LED display, which includes: the temperature sensing block, the signal conditioning block, the analog-to-digital convert block, the display control block and the temperature display block. The digital and analog circuit fundamentals are required to be reviewed before the lab work.
Experiments should be finished during the class. After finishing the design and test of the circuit, the solderless breadboard should be checked and a report should be submitted. Grading will be based on when and how the design is finished, and the quality of the report.

Prerequisite(s): Fundamental of Circuit Analysis, Fundamentals of Digital Circuits and Analog Circuits, Communication Circuit

101052203 Signals and Systems
The course is an essential course for students studying in diverse areas of science and technology

such as communications, aeronautics astronautics, circuit design, acoustics and bio-medical engineering. The course covers fundamentals of signal and system analysis, with applications drawn from filtering, audio and image processing, communications, and automatic control. Topics include convolution, Fourier series and transforms, sampling and discrete-time processing of continuous-time signals, modulation, Laplace and Z-transforms.

Prerequisites: Basis of Circuit Analysis, Function of Complex Variable

101052206 Digital Signal Processing

This course is designed to give students a thorough understanding of techniques needed for the analysis of discrete-time signals and systems. This course is introduces signals and systems in discrete time; the analysis of discrete signals via discrete Fourier transform; the study of fast Fourier transform algorithms; design and implementation of IIR and FIR digital filters. Computer simulations using Matlab will be required in the laboratory.

Prerequisite(s): Signals and Systems

101052272 Light Level Labwork of Signal and Information Processing I

This course focuses on the implementation skills of signals and systems. The students will learn to use Matlab, understand the analysis method of time and frequency domain for signals and systems, and build up self-study and practical ability.

Prerequisite(s): Signals and Systems

101052274 Light Level Labwork of Signal and Information Processing II

This course focuses on the implementation skills of digital signal processing. The goal is to know the analysis method of signal spectrum, to understand the IIR and FIR methods of digital filtering design, to develop the students' self-study ability and practical ability.

Prerequisite(s): Signals and Systems, Digital signal processing

101052377 Labwork of Signal and Information Processing

This course focuses on the training of signal and information processing, equips the students with the analysis method of signal and information processing and develop their self-study ability and practical ability to apply theoretical knowledge to actual engineering problem-solving.

Prerequisite(s): Signals and systems, Digital signal processing, Random signal analysis, An introduction to modern spectral estimation

101053205 Algorithm and Data Structure

This course presents fundamental concepts in data structures and algorithm analysis. It provides students an opportunity to further develop and refine their programming skills. In particular, the emphasis of this course is on the organization of information, the implementation of common data structures such as lists, stacks, queues, trees, and graphs, and techniques of data abstraction, including encapsulation and inheritance. The goals of this course are to acquaint students with structures used when programming for the storage and manipulation of data. C and C++ will be extensively used in the class, homework, and project.

Prerequisite(s): Computer Technologies and Programming, Programming Implementation in C

101053272 Light Level Labwork of Computer and Network I

This course is a lab course for algorithm and data structures. It provides students an opportunity to further develop and refine their programming skills. In particular, the emphasis of this course is on the organization of information, the implementation of common data structures such as lists, stacks, queues, trees, and graphs, and techniques of data abstraction, including encapsulation and inheritance. The goals of this course are to acquaint students with structures used when programming for the storage and manipulation of data. C and C++ will be extensively used in this course.

Prerequisite(s): Computer Technologies and Programming, Programming Implementation in C

101053308 Computer Principle and Application

This course introduces the basic concepts of computer, the organization of a real computer system, the general programming structure of Intel 80x86 CPU, basics of assembly language, and microcomputer bus structure; explores the interface techniques; expounds interruption principle of 80x86 systems; studies the memory system structure and designs several mini processor-based digital systems. Assembly language programming will be extensively used in the class, the homework, and the project.

Prerequisites: Fundamentals of Analog Circuits，Digital Electronics，The C Programming Language.

101053374 Light Level Labwork of Computer and Networks II

The course focuses on the fundamental implementation skills of computer-centered application systems. The goal is to give a big picture of the designation of an application system designation, which includes: the development environment of assembly language, MASM, under Windows system; programming with assembly language; the CPU architecture and how it works; the organization of system memories; the programming methods of serial interface, parallel interface, timer, and interrupts controller; and the system communications.

Prerequisite(s): Computer Principles and Applications B, Digital Circuit designation, C programming language, The basis of computer science, Analog Circuit

101053376 Labwork of Computer and Networks

This course requires the students to master basic principles and techniques of computer and network. The main topics and structure of the course are based on Curriculum Design of Computer and Networks. Part 1: overall plan of the project, using multimedia and traditional teaching methods to display application of pictures, explain supplemental knowledge, and for classroom discussion; Part 2: Project design report, multimedia and traditional teaching methods are used; Part 3: Project engineering system, case teaching, class Q & A. Part 4: Project presentation, multimedia technology, physical display and discussion.

Prerequisite(s): (a) must be taken and passed (b)must be taken (c)be suggested to take first.
(a) Fundamentals of Computer Application.(b) None. (c) The principle and technology of computer, Information Network.

101054203 Electromagnetic Field Theory and Microwave Engineering

This is an introductory undergraduate level course related to the area of Electromagnetic Theory and Microwave Engineering. Based on the intuitive knowledge from General Physics electromagnetic, the Electromagnetic Theory derives the theory from scratch via advanced mathematics. It covers the fundamental principles of electromagnetism: vector fields, electro- and magneto- statics, electric and magnetic properties of materials, time varying fields, Maxwell's equations, radiation and propagation of electromagnetic waves, and antenna and antenna system design. Based on the knowledge of Electromagnetics, Microwave Engineering provides the essential information which distinguishes a microwave engineer apart from a "normal" electrical engineer. A detailed explanation on the fundamental concepts of Microwave Engineering as well as real life examples will be given. The students will be required to master transmission line theory, microwave network theory, microwave components, microwave circuit design, and microwave measurement techniques.

Prerequisite(s): Calculus, Physics I, II, Linear Algebra, Mathematical Equation and Special Functions, Complex Variable Functions and Integration Transformation

101054375 Labwork of Electromagnetic Field and Microwave

This course is a professional basic course suitable for electronic information specialty. It will inevitable involve various microwave transmission line and microwave devices in the process of electronic information transmission and processing, especially in the microwave signal transmission and processing. Therefore, future electronic engineer must have the basic knowledge of microwave engineering. In addition, this course is the foundation for the following courses: Antenna Theory and Technology, Electromagnetic Radiation and Transmission, Microwave Electronic Circuit, Microwave Measurement, and Fundamentals of Electromagnetic Compatibility.

Prerequisite(s): Mathematical Analysis for Engineering, College Physics, The Theory of Electromagnetic Fields B, Principles of Microwave Technology B. Linear Algebra, Equations of Mathematical Physics & Special Functions, Complex Function and Integral Transform

101055303 Fundamentals of Control Theory

This course focuses on the analysis and design of systems control. The course will present a clear exposition of the basic principles of frequency- and time-domain design techniques. The classical methods of control engineering are thoroughly covered: Laplace transforms and transfer functions; root locus design; Routh-Hurwitz stability analysis; frequency response methods, including Bode, Nyquist, and Nichols; steady-state error for standard test signals; second-order system approximations; and phase and gain margin and bandwidth. In addition, coverage of the state variable method is significant. Fundamental notions of controllability and observability for state variable models are discussed. Full state feedback design with Ackermann's formula for pole placement is presented, along with a discussion on the limitations of state variable feedback. Observers are introduced as means to provide state estimates when the complete state is not measured.

Prerequisite(s): Linear algebra, Differential equation

101055372 Light Level Labworks of Fundamentals of Control Theory

These experiments focus on control system modeling and analysis. Each experiment is to explore the principles of system modeling from simple one to complicated one. Varies of system testing tools are presented, including tool of frequency analysis, tool of time domain analysis and tool of z domain analysis. In addition, toolbox of modern control system is presented for state variable models.

Prerequisite(s): C program, Matlab, Linear algebra

101056303 Semiconductor Physics and Device Modeling

The course examines the fundamentals of semiconductor and the models of microelectronic devices for silicon integrated circuit designs. The topics include: Electron state in semiconductors, Carrier statistics in equilibrium, Carrier transport, Non-equilibrium excess carrier, P-N Junction, Metal-semiconductor junction, Metal-insulator-semiconductor structure, Metal-oxide-semiconductor field effect transistor, Bipolar junction transistor. The course emphasizes physical understanding of basic semiconductor concepts and application of device models.

Prerequisite(s): College Physics，Fundamentals of Analog Circuits

101056408 Integrated Circuits Engineering

This course explores the modeling of the very large scale integrated circuit(VLSI) in modern society; analysis of timing and power of the very large scale integrated circuit; study of the classical VLSI design methods using EDA tools, and the development of the analog IC and the digital IC. The current IC design tools will be extensively used in the class, the discussion, and the project.

Prerequisite(s): Fundamentals of Analog Circuits, Digital Electronics and Semiconductor Physics and Device Modeling

101056474 Embedded System Design and Verification

This course introduces how to design and implement the embedded system and analyze its performance. Hardware and software architecture of the embedded system, the tool chain and the system performance analysis will be included.

Prerequisites: Fundamentals of Digital Circuit, The C Programming Language

101057303 Digital Communication Principles

The course is designed to provide students with a sound fundamental education in the areas of digital communications. The main contents include spectral analysis; random signal theory; information theory; digital transmission through AWGN channels; digital carrier-modulation schemes; error control coding; optimum receivers; carrier and symbol synchronization; multiuser communications.

Prerequisite(s): Random signal analysis, Signals and Systems

101057372 Light Level Labwork of Digital Communication Principles

The course is designed to provide students with a sound fundamental education in the areas of digital communications. The main contents include spectral analysis; digital baseband transmission; digital carrier-modulation schemes; error control coding; multiuser communications.

Prerequisite(s): Random signal analysis, Signals and Systems

101057410 Electronic Communication Systems

This is an elective course for the students major in electronics engineering, communication engineering, electronic science and technology. The course is designed to prepare students for modern telecommunication industry. Topics includes: the basic principles and components of Data communication and Internet, Microwave communication, Satellite communication, Telephone communication, Optical communication, Cell-phone and Wireless Communication systems.

Prerequisite(s): Principles of Digital Communication, Data Communication and Networking

101058406 Data Communication and Networks

This course is a required for the Electronics Engineering major. The course focuses on the fundamentals of data communication and networks. It is organized with the TCP/IP model, and lectures are arranged in order of Physical Layer, Data Link Layer, Network Layer, Transport Layer, and Application Layer.

Prerequisite(s): Data Structure and C/C++ Programing

107050207 Engineering Innovation Design I

Engineering Innovation Design I-VI is a lab work serials through four-year study of electronics and communications. The course follows the pedagogical concept of CDIO (Conceive Design Implementation and operation). Six projects will be offered by the course covering skills training for software development and hardware development. Engineering Design I is focus on training of software design skills. Each student will act as part of a project team and utilize a variety of multimedia software to creatively design and implement a software project.

Prerequisite(s): Computer Technologies and Programming, Programming Implementation in C

107050208 Engineering Innovation Design II

Engineering Innovation Design I-VI is a lab work serials through four-year study of electronics and communications. The course follows the pedagogical concept of CDIO (Conceive Design Implementation and operation). Six projects will be offered by the course covering skills training for software development and hardware development. Engineering Design II is focus on software engineering practices, case studies and collaboration in engineering projects. It will provide future engineering students with an opportunity to design develop and to build apps using a variety of tools.

Prerequisite(s): Computer Technologies and Programming, Programming Implementation in C

Course Syllabus

101051203 Fundamentals of Circuit Analysis

Lecture Hours: **48**
Laboratory Hours: **0**
Credits: **3**
Prerequisites: College Physics, Higher Mathematics

Course Description:

Fundamentals of Circuits Analysis is an important academic foundation for all information and electrical specialties. It mainly introduces the basic concepts, basic theories, and basic analysis methods of the circuits, especially linear circuits. The course systematically introduces electric circuit model, Kirchhoff's law, circuit theorems, and equivalent transformation of circuit model, basic analytical method of linear resistance electric circuit, the ideal operational amplifier circuit, the transient analysis of first-order circuits, the transient analysis of second-order circuits, the steady-state analysis of sinusoidal circuit, calculation of three-phase circuit, the analysis of circuit with mutual inductance, calculation of non-sinusoidal current circuit.

This course is the foundation on which most other courses in the electrical engineering curriculum rest. By learning the course, students will know the basic circuit theory, analysis and calculation methods. The course will help to prepare basic knowledge of the following relevant courses.

Course Outcomes:

After completing this course, a student should be able to:

Analyze the resistors circuits, the dynamic circuits, the sinusoidal steady-state circuits and the non-sinusoidal periodic current circuits.

1. Find and solve the circuit problems in an electronic system with mathematic and circuit theory.
2. Select or build the model of an electronic circuit or component, and solve the model.
3. Get the foundation to design a component, unit or system for a specific requirement.

Course Content:

Lectures and Lecture Hours:

1. Circuit models and laws 6
   - Realistic circuit and circuit model.
   - Voltage, current and reference direction.
   - Power and energy.
   - Kirchhoff's law.
   - Resistor and Ohm's law.
   - Voltage source, current source and dependent source
   - Linear and nonlinear.
   - Time-vary and time-invariant.

- Active and passive.

2. Resistor circuit analysis 12
   - Equivalent circuit, series resistors and parallel resistors, Wye-Delta transformation, equivalent of resistor circuit with source.
   - Branch analysis, mesh analysis, node analysis.
   - Superposition, replace theorem, Thevenin's law, Norton's law, maximum power transfer.
   - Simple nonlinear resistor circuit analysis.
   - Ideal operational amplifier circuit analysis.
3. Dynamic circuit analysis 10
   - Capacitors, Inductors and their voltage-current relation. Energy in capacitors and inductors. Initial-state.
   - First-order circuit equation, time constant, natural response, step response, complete response, steady-state and temporary-state.
   - Step function, step response.
   - Second-order circuit equations, natural frequency.
   - Oscillation in RLC circuit.
4. Sinusoidal steady-state circuit analysis 16
   - Sinusoidal signal's period, frequency, angular frequency, instantaneous value, amplitude, effective value, phase, phase difference. Sinusoidal signal's trigonometric form, waveform, phasor and phasor diagram.
   - The KVL and KCL in phasor, voltage-current relation in phasor. Impedance and admittance. Equivalent circuit of the sinusoidal steady-state circuit.
   - Average power, power factor, apparent power, complex power.
   - Mutual inductor's voltage-current relation of, dot, coefficient of coupling. Analysis of circuit with mutual inductors.
   - Ideal transformer's voltage-current relation, impedance ratio. Complete-coupled transformer.
   - Network functions in sinusoidal steady-state circuit.
   - RLC series/parallel circuit's frequency response, resonance frequency, characteristic impedance, quality factor, pass-band. RC low-pass and high pass circuit.
   - Balanced three-phase voltages, currents and power calculation.
5. Non-sinusoidal periodic current circuit analysis 4
   - Non-sinusoidal periodic current, voltage and their RMS value.
   - Non-sinusoidal periodic current circuit calculation.
   - Non-sinusoidal periodic current circuit power.

Grading:

Homework	25%
Inclass Quizzes	10%
Final	60%
Instructor Evaluation	5%

Text & Reference Book:

James W. Nilsson, Susan A. Riedel, Electric Circuits, 9th ed., 2012, ISBN 9787121157349.

101051206 Fundamentals of Analog Circuits

Lecture Hours: **48**
Laboratory Hours: **0**
Credits: **3**
Term(If necessary):
Prerequisite(s): Fundamentals of Electric Circuit Analysis

Course Description:

This course will explore the electronic devices and the analog electronic circuits. It covers semiconductor pn junction and transistors, small and large signal amplifiers, feedback amplifier analysis, frequency response of BJT and FET amplifiers, and frequency response with feedback stability, operational amplifier circuitry and applications.

Course Outcomes:

After completing this course, a student should be able to:

1. Develop basic concepts and techniques used in analog electronics
2. Analyze analog circuits containing diodes, transistors and Op-Amp.
3. Design analog circuits containing diodes, transistors and Op-amp.

Course Content:

1. Introduction 2
   - analog signal and digital signal
   - course contents
2. Semiconductor material and diodes 4
   - Semiconductor material, PN junction
   - Diodes and its application
3. Field Effect Transistors 4
   - Operation theory of MOSFET, Current-voltage characteristics of MOSFET
   - MOSFET DC Circuit Analysis
   - basic application of FET
4. FET Amplifiers 4
   - Small signal equivalent circuit of FET
   - CS, CG and CD FET amplifiers.
   - MOSFET and JFET amplifiers and the general characteristics,
   - Multistage Amplifiers
5. Bipolar junction transistor amplifier 4
   - Operation theory of BJT. BJT biasing
   - Small-signal equivalent circuit of BJT, general characteristics, AC load line analysis
   - Multistage amplifiers, power considerations and design application
6. Amplifier frequency response 6
   - Low frequency response of FET and BJT amplifiers
   - High Frequency response of FET and BJT amplifiers
   - System transfer functions
   - Bode plot
7. Power Amplifiers 2

- Power transistors, classes of amplifiers
- Class B and Class AB amplifiers

8. Op-amp circuitry 6
   - Current sources and biasing circuit of op-amp
   - Differential pair
   - Active Loads
   - General op-amp circuit design
9. Feedback Amplifier 8
   - Basic feedback concepts
   - Feedback topologies and identification, voltage amplifiers
   - Current amplifiers, transconductance amplifiers, transresistance amplifiers.
   - Stability of the feedback circuit, frequency compensation
10. Op-Amp applications 8
    - Ideal op-amp characteristics and practical Op-Amp parameters
    - Inverting amplifier, noninverting amplifier, Summation, subtract, integrator and differentiator
    - offset, SR, CMRR, Bandwidth
    - voltage regulator
    - Comparators

Grading:

Q &A and class performance	5%
Test	15%
Homework	10%
Final exam	70%

Text & Reference Book:

Donald A. Neamen, Microelectronics: Circuit Analysis and Design, 3th ed. 2007, ISBN 978-7-302-15683-3

101051209 Digital Circuits

Lecture Hours: **48**
Laboratory Hours: **0**
Credits: **3**

Prerequisite(s): Fundamentals of Electric Circuit Analysis, Fundamentals of Analog Circuits

Course Description:

The course includes the following chapters: fundamentals of digital circuits, transistor fundamentals, number system, Boolean algebra, Karnaugh maps, logic gates, arithmetic circuits, flip-flops, counters, registers, memory and finite state machine. The students need to preview the related topic before each class. Homework will be assigned according to each chapter. There are 5 quizzes during the whole semester; There is one final project and you can work in groups (max. 2 in each group). Grading will be based on the project report and PowerPoint presentation. Late submission will result in a ZERO.

Course Outcomes:

After completing this course, a student should be able to:

1. Understand the basic theory of digital circuit.
2. Analyze CMOS logic gates behavior.
3. Analyze the timing of CMOS sequential circuits
4. Design and verify a basic digital system.

Course Content:

Lectures and Lecture Hours:

1. Intro/ Number Systems/Binary, Hexadecimal and Oct Numbers	2
2. Conversions, Arithmetic, Complements	1
3. Signed Numbers and arithmetic	1
4. BCD （8-4-2-1 code）and Digital codes	1
5. QUIZ1/HOMEWORK	1
6. Logic Gates	2
7. Transistor Electrical Characteristics	1
8. Boolean Algebra	2
9. Standard Forms and Truth Tables	2
10. Karnaugh Map	2
11. REVIEW/HOMEWORK	1
12. EXAM I	2
13. Combinational Circuits	2
14. Universal Gates	2
15. Adders and Comparators	2
16. Decoders, Encoders	1
17. Multiplexers and Demultiplexers	1
18. Combinational Logic Circuit Analysis and Design	2
19. QUIZ 3 / HOMEWORK	1

20. Latches	2
21. Flip Flops	2
22. Counters	2
23. Synchronous Counters	1
24. Registers	2
25. Memory	1
26. Finite State Machine	4
27. QUIZ 4/REVIEW	1
28. Final Project	12
29. Final Exam	

Grading:

Homework	10%
Quiz	10%
Final Project	20%
Mid-term Exam	10%
Final Exam	50%

Text & Reference Book:

Floyd, Thomas L., Digital Fundamentals, Ninth Edition, Prentice-Hall Inc., Upper Saddle River, NJ, 2006, 1997.

101051272 Technique Practice of Electronic Systems

Lecture Hours: 8
Laboratory Hours: 24
Credits: 1
Prerequisite(s): None

Course Description:

It is a basic course of experiment, which is suitable for electronic information specialty. Before the study of specialized basic courses, the students can get the following basic knowledge and abilities from this course: (1) have an initial understanding of the composition of electronic systems, which include signal reception, signal processing and signal output; (2) master the methods of identification and measurement of electronics components which include Resistor, capacitor, inductance, diode, and transistor etc.; (3) master the test and measurement methods of common instrument, including digital multimeter and digital oscilloscope; (4) master welding technology; (5) training the identify and design ability of primary circuit diagram; (6) training the measurement and debugging ability of primary circuit; (7) know about the working principle of the 555 timer and the basic working principle of black and white television.

Course Outcomes:

After completing this course, a student should be able to:

1. understand the science and technology of electronic information, master the structure of typical electronic system.
2. master the method of identification and measurement of electronics components
3. master the usage method of common instrument, such as digital multimeter
4. master welding technology;
5. possess the basic ability to identify and design the circuit
6. possess the ability to measure and debug the circuit

Course Content:

Lectures and Lecture Hours:

1. introduce the science and technology of electronic information science, explain the structure of typical electronic system 4
2. Explain the process and technology of welding, introduce the principle of electronic door bell and black and white TV set. 4

Laboratories and Laboratory Hours:

1. Weld and debug the electronic doorbell circuit	8
(1) The identification and measurement method of Electronics components	1
(2) The usage of digital multimeter and welding method of PCB	1
(3) Identifying the principle diagram and designing the circuit	1
(4) Disassembly and assembly, welding, debugging electronic doorbell circuit	5
2. The assembly and debugging of Black and white television	16
(1) Review identification and measurement methods of electronic components, know about each unit circuit of TV set	2

(2) Disassemble and assembly of PCB, check the components 2

(3) Welding the components 6

(4) Measure the static working numerical of discrete components and integrated circuit 2

(5) Assemble and debug the black and white television 4

Grading:

Circuit welding	70%
Circuit debugging	30%

Text & Reference Book: N/A

101051274 Electronic Labwork I

Lecture Hours: 8
Laboratory Hours: 24
Credits: 1
Term: the first term of sophomore year
Prerequisite(s): Fundamentals of Circuit Analysis

Course Description:

Through the theoretical teaching, students will understand the concepts of digital audio, digital video, coding and decoding, embedded system, digital product, grasp the working principle of MP3 main controlling chip. Furthermore, students will understand the principle diagram of the MP3 digital player, and can analyze the fault causes of MP3 digital player according to the principle diagram.

Through the lab work, the students will have practical knowledge on electronic components, electronic materials and the production process of electronic products, so as to get the general knowledge of electronics technology. At the same time, the students will understand the reflow soldering technology, and master manual welding skills.

Course Outcomes:

After completing this course, a student should be able to:

1. Understand the concepts of digital audio, digital video, coding and decoding, embedded system and digital product.
2. Grasp the working principle of MP3 main controlling chip and MP3 digital player.
3. Master SMT process and the usage of common instruments, and have the skills of reflow soldering and manual welding.
4. Have the abilities of debugging and assembling MP3 digital player, and independently complete the production process of a MP3 digital player.

Course Content:

Laboratories and Laboratory Hours:

1. The concepts of digital audio, digital video, coding and decoding, embedded system, digital product, MP3 main controlling chip and MP3 principle diagram. 4
2. General knowledge of SMT technology and production process of electronic products. The usage of common instruments. 4
3. The layout of the PCB and the methods of reflow soldering and manual welding. 12
4. Measurement of the key point voltage. Debugging, assembling and acceptance of MP3 digital player. 12

Grading:

Theory class	20%
Circuit welding	30%
Circuit debugging	30%
Test report	20%

Text &Reference Book:

1. MP3 digital player production notes.
2. Bo Chong technology. MP3 player and U disk design. Beijing: Tsinghua University press, 2004.
3. Wang Weiping, Chen Susong. Electronic product manufacturing technology M. Beijing: Higher Education Press, 2005.

101051276 Electronic Labwork II

Laboratory Hours: 32
Credits: 1
Prerequisite(s): None

Course Description:

The students will know about the wireless communication history; be familiar with the generation and propagation principle of electromagnetic wave, the characteristics of electromagnetic wave transmission and the principle of receiving and emitting; the circuit and working principle of PJ - 80 type radio direction-finding receiver; master how to receive signal and how to identify the radio call sign; understand the principle of functional direction finder module, which includes high frequency amplification circuit, diode mixer circuit, oscillation circuit, audio amplification and power amplification circuit. Welding, debugging and measurement and the actual direction finding on the PJ-80 direction finder circuit will be carried on in the class.

Course Outcomes:

After completing this course, a student should be able to:

1. Be familiar with the generation and propagation principle of electromagnetic wave
2. establish the basic concepts of wireless communication transmitting and receiving
3. measure signal by oscilloscope
4. master the Signal demodulation principle of PJ-80

Course Content:

Lectures and Lecture Hours:

1. the generation and emission of electromagnetic wave The basic conception of signal emitting and receiving	3
2. the circuit and working principle of PJ-80	3
3. identification , measuring and Welding the Electronic components	7
4. measuring the Static parameters of circuit, debugging PJ-80	3
5. the training of Direction finding	3
6. the measuring of sensitivity and amplitude-frequency characteristic of BJ-80	8
7. the examine of Direction finding	5

Grading:

Circuit welding	40%
Circuit debugging	40%
Test report	20%

Text & Reference Book: N/A

101051278 Light Level Labwork of Circuit and Electronic Circuits I

Lecture Hours: 0
Laboratory Hours: 32
Credits: 1
Term: the second term of freshman year
Prerequisite(s): Mathematical Analysis for Engineering

Course Description:

This course is one of the most important experiment courses of Electrical Specialty in colleges and universities. Students are required to grasp the necessary basic knowledge of circuit analysis when learning this course. The primary content includes analysis of electromagnetic phenomena in the circuit, exploring and verifying the basic laws as well as the design and analysis methods of electric circuit. The students will build up scientific thinking and develop capacity of experimental research and scientific induction, establish a rigorous scientific attitude and engineering viewpoint of applying theory to reality.

Course Outcomes:

After completing this course, a student should be able to:

1. Master the basic laboratory operation skill and the usage of common instruments.
2. Design simple circuits, analyze and eliminate simple circuits' faults.
3. Deeply understand the circuit theory through analyzing the circuit experiment phenomenon.
4. Analyze and solve problems with a rigorous scientific attitude.
5. Master the simulation of software in the circuit experiment and the operation of the software.

Course Content:

Laboratories and Laboratory Hours:

(Hardware)

1. Measurement of the volt-ampere characteristics of fundamental components 4
2. The equivalent circuit of an active single-terminal pair and the measurement of the parameters of the equivalent circuit 3
3. Study on the response of first order dynamic RC circuit 3
4. Study on the response of second order dynamic series RLC circuit 3
5. The impedance-frequency characteristic of the single component 3

(Software)

1. Verification of Thevenin theorem 1
2. Verification of superposition principle 1
3. Responses of Second-Order RLC Circuits(parallel) 2
4. Responses of Second-Order RLC Circuits(series) 2
5. Responses of Operational Amplifiers(OpAmps) 2

Grading:

(Hardware)	
Preview	10%
Operation	70%
Report	20%
(Software)	
Preview	10%
Operation	70%
Report	20%

Text & Reference Book:

Fundamentals of Circuit Analysis, 4th ed., 2006, ISBN 9787040184709.

101051280 Light Level Labwork of Circuit and Electronic Circuits II

Lecture Hours: **0**
Laboratory Hours: **24**
Credits: **0.75**
Term: sophomore second term
Prerequisite(s): Fundamentals of Analog Circuits

Course Description:
This course is to implement analog circuit using transistors or operational amplifiers; design an analog amplifier for specific applications; analyze the relation between the characters of an amplifier; analyze and design a rectifier and voltage regulator. Electrical measurement devices will be extensively used in the class.
Course Outcomes:
After completing this course, a student should be able to:
1. Analyze and design an amplifier using transistors.
2. Analyze and design a rectifier and voltage regulator.
3. Design amplifiers for specific applications using operational amplifiers.
4. Implement the amplifier and measure its characters.
5. Analyze the relation between the characters of an amplifier.

Course Content:
Laboratories and Laboratory Hours:
(Hardware)

1. research of RC-coupled amplifier	4
2. research of rectifier and voltage regulator	4
3. research of cascaded feedback amplifier	4
4. research of integral operation amplifier	4
(Software)	
5. research of RC-coupled amplifier	4
6. research of integral operation amplifier	4

Grading:

(Hardware)	
Operation	80%
Report	20%
(Software)	
Operation	80%
Report	20%

Text & Reference Book:
Donald A.Neamen , Microelectronics: Circuit Analysis and Design,, 4^{th} ed., 2010.

101051282 Light Level Labwork of Circuit and Electronic Circuits III

Lecture Hours: **8**
Laboratory Hours: **24**
Credits: **1**
Prerequisite(s): **Fundamental of Circuit Analysis, Fundamentals of Digital Circuits design, Fundamentals of circuit simulators**

Course Description:

The course includes two parts: the hardware design and software design of digital circuits. There are three experiments for the hardware design: the first one is to learn about the logic function of gates, such as NAND gates, NOR gates, XOR gates, etc.; the second one is the design and test of integrated counters, and the third one is the application of commonly used CMOS integrated circuits. After the three laboratory, students should master the method to test the logic function of gates and commonly used circuits, be familiar with the usage of test equipment and integrated chips. In the software design parts, the students will complete the design of the simple convolution, a complete testbench is also required to test the design.

The digital circuit fundamentals is required in this class. The basic Verilog HDL language and the ModelSim simulator are essential for the software design experiments. The students need to preview the related topic before the laboratory.

Experiments should be finished during the class. After finishing the design and test of the circuit, the solderless breadboard should be checked and a report should be submitted. Grading will be based on when and how the design is finished, and the quality of the report.

Course Outcomes:

After completing this course, a student should be able to:

1. Master the method to test the logic function of gate and CMOS devices;
2. Be familiar with the usage of pulse oscilloscope and logic box;
3. Master the functions and typical applications of commonly used CMOS integrated circuits.
4. Learn the basic design method of state machine control, interface, memory and AD converter.
5. Write a complete test model, and complete the design and test of commonly used circuits.

Course Content:

Lectures and Lecture Hours:

1.	The usage of test equipment	2
2.	The design and test method devices and circuits	2
3.	The design of Verilog model and test models	2
4.	The method to do a complete test bench	2

Laboratories and Laboratory Hours:

1.	Design and test the logic function of gates	4
2.	Design and test the integrated counters	4
3.	Design and test commonly used CMOS integrated circuits	4

4.	Write Verilog model of the required AD converter	2
5.	Build the control system including the state machine	4
6.	Write a complete test-bench	2
7.	Test and modify the design	2
8.	Summarize the laboratory and finish the report	2

Grading:

Experiment results	80%
Experiment report	20%

Text & Reference Book: **N/A**

101051312 Communication Circuits

Lecture Hours: **48**
Credits: **3**
Prerequisite(s): **Fundamentals of Electric Circuit, Analysis Fundamentals of Analog Circuits, Signals and Systems**

Course Description:

This course covers the analysis of nonlinear circuit in analog communication system; the basic principle and design of Single-tuner resonant power amplifier circuit, sine oscillator, AM modulation and demodulation circuit, FM modulation and demodulation circuit, PM modulation and demodulation circuit, mixer circuit, Phase-locked loop circuit, and the design of analog communication system.

Course Outcomes:

After completing this course, a student should be able to:

1. Know the basic elements of analogy communication system and their function,
2. Analyze basic circuit in analogy communication in time-frequency domain, such as resonant power amplifier circuit, sine oscillator, AM/FM/PM modulation and demodulation, mixer circuit, PLL circuit.
3. Understand the main design discipline of analogy communication system.
4. Analyses variable kinds of noise and their effects on the communication circuit.

Course Content:

Lectures and Lecture Hours:

1. Introduction to communication system	6
- Element of a Communication System	
- Time and Frequency Domains	
- Noise and Communications	
- Spectrum Analysis	
2. Radio-Frequency Circuits	12
- High-Frequency Effects	
- Radio-Frequency Amplifiers	
- Radio-Frequency Oscillators	
- Mixer	
3. Amplitude Modulation	7
- Full-Carrier AM: Time Domain	
- Full-Carrier AM: Frequency Domain	
- Quadrature AM and AM Stereo	
- Suppressed-Carrier AM	
4. Angle Modulation	8
- Frequency Modulation	
- Phase Modulation	
- The Angle Modulation Spectrum	

- FM and Noise
- FM Stereo and Measurements

5. Transmitters 7
   - Transmitter Requirements
   - Transmitter Topologies
   - Full-Carrier AM Transmitters
   - Single-Sideband AM Transmitters
   - FM Transmitters
   - Transmitter Power Measurement
6. Receiver 8
   - Receiver Topologies
   - Receiver Characteristics
   - Demodulators
   - Receiver Variations
   - Communication Receivers
   - Transceivers
   - Receiver Measurements

Grading:

Inclass Quizzes	10%
Homework	10%
Final	80%

Text & Reference Book:

[1] Roy Blake, Electronic Communication Systems[M], Publishing House of Electronics Industry. 2th ed.

[2]John G.Proakis, Masoud Salehi. 樊昌信改编. Fundamentals of Communication System[M]. Publishing House of Electronics Industry.

[3]罗伟雄主编.通信电路与系统[M]. 北京理工大学出版社

101051384 Light Level Labwork of Circuit and Electronic Circuits IV

Lecture Hours: **0**
Laboratory Hours: **16**
Credits: **0.5**
Prerequisite(s): Communication Circuit

Course Description:

This course will research on the unit module of nonlinear circuit in analog communication system by analyzing Colpitts oscillators, amplitude modulation and demodulation, mixer, phase detector, and phase-locked loops. Study is based on experiment boxes using measurement equipment.

Course Outcomes:

After completing this course, a student should be able to:
1. Analyze the Colpitts oscillators by looking at their stabilities.
2. Analyze the amplitude modulation and demodulation.
3. Analyze performance of integrated mixer.
4. Analyze performance of frequency modulator and phase detector.

Course Content:

Laboratories and Laboratory Hours:

1.	Study of the Colpitts oscillators	4
2.	Study of the amplitude modulation and demodulation	4
3.	Study of the Integrated mixer	4
4.	Study of the frequency modulator and the phase detector	4

Grading:

Experiment results	50%
Experiment report	50%

Text & Reference Book: **N/A**

101051386 Labwork of Circuit and Electronic Circuits

Lecture Hours: **4**
Laboratory Hours: **60**
Credits: **2**
Prerequisite(s): Fundamental of Circuit Analysis, Fundamentals of Digital Circuits and Analog Circuits, Communication Circuit

Course Description:

The content of this course is to design and implement two digital-analog mixed system: 1. Design an infrared remote-control emitter/receiver, which includes: the encoder and decoder, the modulator and demodulator, and the display; 2. Design a digital thermometer with LED display, which includes: the temperature sensing block, the signal conditioning block, the analog-to-digital convert block, the display control block and the temperature display block. The digital and analog circuit fundamentals are required to be reviewed before the lab work.
Experiments should be finished during the class. After finishing the design and test of the circuit, the solderless breadboard should be checked and a report should be submitted. Grading will be based on when and how the design is finished, and the quality of the report.

Course Outcomes:

After completing this course, a student should be able to:
1. Be familiar with the digital-analog mixed system concept.
2. Use the power supply, signal generator and oscilloscope.
3. Understand the basic method of electronic circuit design.
4. Use engineering concepts to design a complete digital-analog mixed system and test it.

Course Content:

Lectures and Lecture Hours:

1. Design method for a digital-analog mixed system	2
2. The application of typical circuits	2

Laboratories and Laboratory Hours:

1.	Finish the basic block diagram of the project	4
2.	Design and test the encoder and decoder	4
3.	Design and test the modulator	4
4.	Design and test the demodulator	4
5.	Design and test the display	4
6.	Test and modify the whole circuit design	4
7.	Calibrate the design to the required performance	4
8.	Finish the basic block diagram of the project	4
9.	Design and test the temperature sensing block	4
10.	Design and test the temperature amplifier logic	4
11.	Design and test the A/D convert logic	4
12.	Design and test the display logic	4
13.	Test and modify the whole circuit design	4
14.	Calibrate the design to the required performance	4

15. Summarize the laboratory and finish the report 4

Grading:

Experiment results	80%
Experiment report	20%

Text & Reference Book: N/A

101052203 Signals and Systems

Lecture Hours: 48
Laboratory Hours: 0
Credits: 3
Prerequisites: Basis of Circuit Analysis, Function of Complex Variable

Course Description:

The course is an essential course for students studying in diverse areas of science and technology such as communications, aeronautics astronautics, circuit design, acoustics and bio-medical engineering. The course covers fundamentals of signal and system analysis, with applications drawn from filtering, audio and image processing, communications, and automatic control. Topics include convolution, Fourier series and transforms, sampling and discrete-time processing of continuous-time signals, modulation, Laplace and Z-transforms.

Course Outcomes:

After completing this course, a student should be able to:

1. Use convolution integral/sum to gain output of an LTI system.
2. Analyze systems using Fourier Transforms, Laplace Transforms and Z-transforms.
3. Analyze spectrum in frequency domain.
4. Gain the basic concept of modeling based on systems.

Course Content:

Lectures and Lecture Hours:

Chapter 1 SIGNALS AND SYSTEMS （6 hours）

Introduction
Continuous-Time & Discrete-Time Signals;
Transformations of the Independent Variable;
Exponential & Sinusoidal Signals;
The Unit Impulse and Unit Step Functions;
Continuous-Time and Discrete-Time Systems;
Basic System Properties.

Chapter 2 LINEAR TIME-INVARIANT SYSTEMS （4 hours）

Discrete-Time LTI Systems: The Convolution Sum;
Continuous-Time LTI Systems: The Convolution Integral
Properties of Linear Time-Invariant Systems
Causal LTI Systems Described by Differential and Difference Equations
Singularity Functions

Chapter 3 FOURIER SERIES REPERSENTATION OF PERIODIC SIGNALS （4 hours）

Fourier Series Representation of Continuous-Time Periodic Signals
Fourier Series Representation of Discrete-Time Periodic Signals
Fourier Series and LTI Systems
Filtering

Chapter 4 THE CONTIOUOUS-TIME FOURIER TRANSFORM （8 hours）

Fourier Transform Representation of an Aperiodic Signal

The Fourier Transform for Periodic Signals
Properties of the Continuous-Time Fourier Transform
The Convolution Property

Chapter 5 THE DISCRETE-TIME FOURIER TRANSFORM （6 hours）
The Fourier transform of Discrete-Time Aperiodic Signals
Properties of the Discrete-Time Fourier Transform
The Convolution Properties
Tables of Fourier Transform Properties and Basic Fourier Transform Pairs

Chapter 6 TIME AND FREQUENCY CHARACTERIZATION OF SIGNALS AND SYSTEMS （1 hours）
The magnitude-phase Representation of the Frequency Response of LTI Systems
Group-Delay
Bode Plot

Chapter 7 SAMPLING （2 hours）
The Sampling Property (for Continuous-time Systems);
Aliasing

Chapter 8 COMMUNICATION SYSTEMS （2 hours）
Modulation (Continuous-Time Systems)
Time-Division Multiplexing, Frequency-Division Multiplexing, Amplitude Modulation.

Chapter 9 THE LAPLACE TRANSFORM （8 hours）
Laplace Transform and The Region of Convergence for Laplace Transforms
The Inverse Laplace Transform
Properties of the Laplace Transform
Analysis and Characterization of LTI Systems Using the Laplace Transform
System Function Algebra and Block Diagram Representations
The Unilateral Laplace Transform

Chapter 10 THE Z-TRANSFROM （7 hours）
the z-transform, the Region of Convergence from the z-Transform, the Inverse z-Transform
Properties of z-Transform, common z-Transform Pairs
Analysis and Characterization of LTI Systems Using z-transforms
Systems Function Algebra and Block Diagram Representations
The Unilateral z-Transform

Grading:

Students' grade in this course will be the weighted average of the following component grades:

activities	percentages
Quiz	10%
Home work	10%
Participation, other factors	10%
Final exam	70%

Text & Reference Book:

Oppenheim, Alan, and Alan Willsky. *Signals and Systems*. 2nd ed

101052206 Digital Signal Processing

Lecture Hours: **40**
Laboratory Hours: **8**
Credits: **3**
Prerequisite(s): Signals and Systems

Course Description:

This course is designed to give students a thorough understanding of techniques needed for the analysis of discrete-time signals and systems. This course is introduces signals and systems in discrete time; the analysis of discrete signals via discrete Fourier transform; the study of fast Fourier transform algorithms; design and implementation of IIR and FIR digital filters. Computer simulations using Matlab will be required in the laboratory.

Course Outcomes:

After completing this course, a student should be able to:

1. Analyze discrete-time signals using discrete Fourier transform.
2. Demonstrate the knowledge of circular correlation and fast Fourier transforms.
3. Design the block-diagram representation of FIR and IIR systems to realize digital filter transfer functions.
4. Design digital IIR filters to satisfy given cutoff frequencies and attenuation.
5. Design digital FIR filters to meet specific filtering criteria, including linear phase properties.

Course Content:

Lectures and Lecture Hours:

1. Introduction 3
   - Signals, Systems, and Signal Processing
   - Components of a DSP System
   - Applications of DSP
2. Basic concepts of discrete-time signals and systems 4
   - Discrete time signals and systems
   - Frequency analysis of signals and systems
   - Characterization of LTI systems
3. Discrete Fourier transform (DFT) 9
   - Frequency domain sampling of discrete signals
   - Definition & properties of the DFT
   - Frequency analysis of signals using the DFT
4. Fast Fourier transform (FFT) 9
   - Efficient computation of the DFT: FFT algorithms
   - Radix-2 FFT algorithms
   - Split-Radix FFT algorithms
   - FFT algorithm of real sequence
   - The Chirp-z transform algorithm.
5. Digital Filters 15
   - Structures for FIR systems

- Structures for IIR systems
- Design of FIR filters
- Design of IIR filters

Laboratories and Laboratory Hours:

1.	DFT	2
2.	DFT/FFT Application	2
3.	IIR Design	2
4.	FIR Design	2

Grading:

Homework	10%
Quizzes	10%
Instructor Evaluation	10%
Labs	10%
Final	60%

Text & Reference Book:

J.G. Proakis and D.G. Monalakis, Digital signal processing – Principles, Algorithms, and Applications, 4th Ed., 2007.

101052272 Light Level Labwork of Signal and Information Processing I

Laboratory Hours: 16
Credits: 0.5
Term(If necessary): the Second year of college
Prerequisite(s): Signals and Systems

Course Description:

This course focuses on the implementation skills of signals and systems. The students will learn to use Matlab, understand the analysis method of time and frequency domain for signals and systems, and build up self-study and practical ability.

Course Outcomes:

After completing this course, a student should be able to:
1. Use Matlab for calculation and simulation
2. Analyze continuous-time and discrete-time system in time-domain and system stability
3. Analyze continuous-time and discrete-time system in frequency-domain and system stability
4. understand analog signal's FT and digital signal's DFT
5. Design digital Butterworth filter and Chebyshev filter

Course Content:

Experiments and Laboratory Hours:

1. Introduction to Matlab (4 hours)
   - To be familiar with Matlab work environment
   - To know Matlab's basic operation
   - To generate basic signals and functions,
2. Fourier transform and linear system models (3 hours)
   - To understand analog signal's FT and digital signal's DFT
   - To obtain system's frequency transform function H(jw), and solve system transform's roots
   - To obtain an analog system's frequency response
3. Discrete-time LTI systems and filter design (3 hours)
   -To understand discrete signal's ZT, IZT, h(n), H(ejω), etc
   -To obtain discrete system's zeros and poles, analyze the system stability
   -To know difference equation number solution and program's solution
   -To design digital Butterworth filter and Chebyshev filter
4. Continuous-time LTI system (3 hours)
   -To know time-domain analysis of continuous-time LTI system
   -To obtain the frequency response of a continuous-time system
   -To obtain the continuous-time system's zeros and poles, and analyze the system stability
5. Discrete-time LTI system (3 hours)
   -To understand time-domain analysis of discrete-time LTI system
   -To obtain the frequency response of a discrete-time system
   -To obtain the discrete-time system's zeros and poles, and analyze the system stability

-To calculate the convolution between two finite sequences

Grading:

Attendance (no less than 16 hours)	10%
Inclass quizzes	30%
Final report	60%

Text & Reference Book:

Wang qun, Fan Zheyi. Guide of study and experiment for signal and system. Beijing: Beijing institute of technology press, 2013.

101052274 Light Level Labwork of Signal and Information Processing II

Laboratory Hours: 8
Credits: 0.25
Term(If necessary): the Third year of college
Prerequisite(s): Signals and Systems, Digital signal processing

Course Description:

This course focuses on the implementation skills of digital signal processing. The goal is to know the analysis method of signal spectrum, to understand the IIR and FIR methods of digital filtering design, to develop the students' self-study ability and practical ability.

Course Outcomes:

After completing this course, a student should be able to:

1. Use DFT to analyze signal spectrum
2. Use FFT to implement the fast convolutions
3. Design IIR filter using impulse invariance transformation and bilinear transformation
4. Design FIR filter using window-function method and frequency-sampling method

Course Content:

Experiments and Laboratory Hours:

1. Discrete Fourier Transform (DFT) (2 hours)
   - To understand the Discrete Fourier Transform
   - To use DFT to analyze the DTFT
   - To use FFT to implement the fast convolutions
2. IIR Filter Design (3 hours)
   - To design analog low-pass filters
   - To design a low-pass digital filter using impulse invariance transformation
   - To design a low-pass digital filter using bilinear transformation
3. FIR Filter Design (3 hours)
   - To understand linear-phase FIR filters
   - To design linear-phase FIR filter using window-function method
   - To design linear-phase FIR filter using frequency-sampling method

Grading:

Attendance (no less than 8 hours)	10%
Inclass quizzes	30%
Final report	60%

Text & Reference Book:

Wang Shiyi. Digital signal processing (Revised edition). Beijing: Beijing institute of technology press, 2006.

Vinay K Ingle, John G Proakis. Digital Signal Processing Using Matlab (Print version in English). Beijing: Science press, 2003.

101052377 Labwork of Signal and Information Processing

Laboratory Hours: 24
Credits: 0.75
Term(If necessary): the Third year of college
Prerequisite(s): Signals and systems, Digital signal processing, Random signal analysis, An introduction to modern spectral estimation

Course Description:

This course focuses on the training of signal and information processing, equips the students with the analysis method of signal and information processing and develop their self-study ability and practical ability to apply theoretical knowledge to actual engineering problem-solving.

Course Outcomes:

After completing this course, a student should be able to:

1. Model different typical signals and generate different SNR signals
2. Use FFT to analyze signal spectrum
3. Design IIR or FIR filter for de-noise processing
4. Use Matlab GUI interface manager to display the results of signal processing

Course Content:

Experiments and Laboratory Hours:

1. Typical signals modeling and generation (6 hours)
   - How to model typical signals
   - To generate different SNRs signals
2. Signal spectral analysis (6 hours)
   - To use Fourier transformation to analyze signal spectrum
   - To use power spectral estimation to analyze random signal
3. Digital Filter Design (6 hours)
   -How to design FIR filter
   -How to design IIR filter
   -To remove noise using designed filter
   -To analyze filtering effect
4. GUI interface display design (6 hours)
   -To use Matlab software to study GUI interface manager
   -Design GUI interface manager

Grading:

Attention time (not less than 24 hours)	10%
PPT display	10%
Final report	80%

Text & Reference Book:

[1] Wang Shiyi. Digital signal processing (Revised edition). Beijing: Beijing institute of technology press, 2006.

[2] Vinay K Ingle, John G Proakis. Digital Signal Processing Using Matlab (Print version in English). Beijing: Science press, 2003.

[3] Wang qun, Fan Zheyi. Guide of study and experiment for signal and system. Beijing: Beijing institute of technology press, 2013.

101053205 Algorithm and Data Structure

Lecture Hours: 24
Laboratory Hours: 0
Credits: 1.5
Prerequisite(s): **Computer Technologies and Programming, Programming Implementation in C**

Course Description:
This course presents fundamental concepts in data structures and algorithm analysis. It provides students an opportunity to further develop and refine their programming skills. In particular, the emphasis of this course is on the organization of information, the implementation of common data structures such as lists, stacks, queues, trees, and graphs, and techniques of data abstraction, including encapsulation and inheritance. The goals of this course are to acquaint students with structures used when programming for the storage and manipulation of data. C and C++ will be extensively used in the class, homework, and project.

Course Outcomes:
After completing this course, a student should be able to:
1. Apply data abstraction in programming problems.
2. Become proficient at evaluating the benefits and drawbacks of their design in terms of memory and run time efficiency.
3. Use and implement fundamental data structures including lists, stacks, queues, trees and hash tables.
4. Select the proper sorting algorithm for a problem.
5. Design solutions to problems requiring complex data structures (combinations of lists, stacks, queues, hash tables, and trees).
6. Make judgments about the practical and social application of algorithm concepts as they apply to large scale programming projects.

Course Content:
Lectures and Lecture Hours:
1. Intraduction 2
   -What are Data Structures?
   -What are Algorithms?
   -Classes, Encapsulation ADTs.
   -Review C languages.
2. Linear Lists 3
   -Linked Lists
   -Doubly-Linked Lists and Circular Lists
3. Queues and Stacks 2
   -Queues
   -Stacks
4. Trees 4

-Trees' terms
-Tree Traversal Algorithms
-Huffman Tree

5. Graphics 4
6. Searching Algorithms 3
   -Sequential list searching
   -Binary sorting tree
   -Hash Tables
7. Sorting Algorithms 4
   -Insert Sorting
   -Quick Sorting
   -Shell Sorting
   -Merging Sorting
   -Heap Sorting.
8. Reviews 2

Laboratories and Laboratory Hours: None

<u>Grading:</u>

Homework:	20%
Programming Assignment:	20%
Final Exam:	60%

<u>Text & Reference Book</u>:

MARK ALLEN WEISS, Data Structures & Algorithm Analysis in C++, 3th ed., 2006, ISBN 0-13-142462-9.

101053272 Light Level Labwork of Computer and Network I

Lecture Hours: 0
Laboratory Hours: 8
Credits: 0.25
Prerequisite(s): **Computer Technologies and Programming, Programming Implementation in C**

Course Description:

This course is a lab course for algorithm and data structures. It provides students an opportunity to further develop and refine their programming skills. In particular, the emphasis of this course is on the organization of information, the implementation of common data structures such as lists, stacks, queues, trees, and graphs, and techniques of data abstraction, including encapsulation and inheritance. The goals of this course are to acquaint students with structures used when programming for the storage and manipulation of data. C and C++ will be extensively used in this course.

Course Outcomes:

After completing this course, a student should be able to:

1. Apply data abstraction in programming problems.
2. Become proficient at evaluating the benefits and drawbacks of their design in terms of memory and run time efficiency.
3. Use and implement fundamental data structures including lists, stacks, queues, trees and hash tables.
4. Select the proper sorting algorithm for a problem.
5. Design solutions to problems requiring complex data structures (combinations of lists, stacks, queues, hash tables, and trees).
6. Make judgments about the practical and social application of algorithm concepts as they apply to large scale programming projects.

Course Content:

Lectures and Lecture Hours:

Laboratories and Laboratory Hours:

1. The Josephus problem, N queens problem and desk calculator simulation	2
2. Binary search tree	2
3. Insertion sort, shell sort, heap sort and quicksort	2
4. Topological sorting	2

Grading:

Lab1：	25%
Lab2：	25%
Lab3：	25%
Lab4：	25%

Text & Reference Book:

MARK ALLEN WEISS, Data Structures & Algorithm Analysis in C++, 3th ed., 2006, ISBN 0-13-142462-9.

101053308 Computer Principle and Application

Lecture Hours: **64**
Laboratory Hours: **0**
Credits: **4.0**
Prerequisites:Fundamentals of Analog Circuits, Digital Electronics, The C Programming Language.

Course Description:
This course introduces the basic concepts of computer, the organization of a real computer system, the general programming structure of Intel 80x86 CPU, basics of assembly language, and microcomputer bus structure; explores the interface techniques; expounds interruption principle of 80x86 systems; studies the memory system structure and designs several mini processor-based digital systems. Assembly language programming will be extensively used in the class, the homework, and the project.

Course Outcomes:
After completing this course, a student should be able to:
1. Comprehend the basic concepts of computer system and the general structure of Intel 80x86 CPU.
2. Describe the components and operation of a microprocessor based computer system including the processor, memory, bus and I-O systems.
3. Master the process of assembling, linking, and debugging assembly program.
4. Analyze and design assembly language program, data structures to solve common engineering, mathematical, and business oriented problems.
5. Understand memory system and computer bus.
6. Command the general interface technologies, and the circuits design and programming of parallel interface 8255A, serial interface 8250/8251A , timer/counter 8253A/54A.
7. Understand the interruption principle of 80X86 system, and master the 8259A technology.
8. Develop the application system with AD/DA for real data acquisition and devices control.

Course Content:
Lectures and Lecture Hours:
1. Introduction 3
   - A brief history of microcomputer
   - The organization of microcomputer
     - General working principles of a computer
2. Data representation 2
   - Numbering systems
     - Data organization
     - Logical operations
3. Architecture of Advanced Processor 4

- Brief introduction of 80 x 86 CPU
- 8086 / 8088 processor and system
- 8086/8088 memory and I/O bus cycles

4.	The 80x86 instruction set	8

- The 80x86 addressing modes
- instruction set

5. Assembly language program structure — 4
   - Assembly language statement syntax
   - Assembler directives
   - Methods of assembling, linking, and debugging assembly language programs
6. Assembly language program control structures — 4
   - Sequences structure
   - Decisions structure
7. Macros and conditional — 2
   - Macros and conditional assembly
8. MS-DOS, BIOS, and file I/O — 3
   - BIOS-level programming
   - MS-DOS programming for file access
9. Semiconductor Memory Interface Technology — 5
   - Memory introduction
   - Memory system structure and design
10. I/O Interface Technology — 13
    - Brief introduction of I/O interface
    - The parallel interface and 8255A-5
    - The timer/counter 8253A/54A and application
    - The DMA controller
11. Programmable Serial Interface — 4
    - Brief introduction of serial communication
    - The 8250/1 serial port chip
12. Interrupts and Programmable Interrupt Controller — 6
    - Brief introduction
    - 8086 / 8088 interruption system
    - Programmable interrupt controller 8259
13. A/D and D/A — 4
    - Brief introduction of data acquisition system
    - A/D description and chip
    - D/A description and chip
14. Microcomputer Bus Structure — 2
    - PC/XT ISA bus
    - PCI bus

Grading:

quizzes	10%
Homework	10%
Final Exam:	80%

<u>Text & Reference Book</u>:

Text Book:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi. The 80x86 IBM PC and Compatible Computers: Assembly Language, Design, and Interfacing. 4th Edition(Photocopy version), Tsinghua University Press.

Reference Book:

1.David A. Patterson, John L. Hennessy, Computer Organization & Design: The Hardware/Software Interface. 4th Edition, Morgan-Kaufmann, 2008.

101053374 Light Level Labwork of Computer and Networks II

Laboratory Hours: **32**
Credits: **2**
Prerequisite(s): Computer Principles and Applications B, Digital Circuit designation, C programming language, The basis of computer science, Analog Circuit

Course Description:

The course focuses on the fundamental implementation skills of computer-centered application systems. The goal is to give a big picture of the designation of an application system designation, which includes: the development environment of assembly language, MASM, under Windows system; programming with assembly language; the CPU architecture and how it works; the organization of system memories; the programming methods of serial interface, parallel interface, timer, and interrupts controller; and the system communications.

Course Outcomes:

After completing this course, a student should be able to:

1. Understand the CPU architecture and how it works;
2. Analyze and solve engineering problems with computer system;
3. Understand the memory organization;
4. Program for the computer control system;
5. Understand and utilize interrupt;
6. Program for serial and parallel communications.

Course Content:

Experiments and Lab Hours:

1. Basic developing environment (3 hours)
   a) How to use the MASM;
   b) The program methods of assembly language;
   c) The basic instructions of 8086/8088;
   d) The method of assembly language program debugging.
2. Arithmetic instructions (3 hours)
   a) The presentation of number and character in computer system;
   b) ADD, SUB, MUL, DIV, and IMUL, IDIV instructions;
   c) The calculation with BCD code.
3. String operations (3 hours)
   a) The string operation instructions;
   b) The addressing of string operation instructions;
   c) The elements of string operation.
4. Switching and Loop (3 hours)
   a) Switching and loop instructions;
   b) Programming methods of switching structure;
   c) Programming methods of loop structure.

5. Procedure and modular programming (3 hours)
    a) Procedure and its designation elements;
    b) The calling methods of procedure.
6. Files on disks (3 hours)
    a) File, directory, and how to read and write a file with FCB;
    b) Understand file code;
    c) The 3cH, 3dH, 3fH and 40H functions of the system interrupt 21H
    d) File pointer and its applications.
7. 8255A (3 hours)
    a) the connection between computer and 8255A;
    b) the working modes of 8255A;
    c) the keyboard interface and programming;
    d) Parallel communication with 8255A.
8. Interrupt and timer 8259 & 8254 (3 hours)
    a) The principles of timer, and the programming of 8254;
    b) Interrupts handling with 8259A;
    c) The system designation of the seven segments light control with 8254 and 8259A.
9. 8251 and serial communications (3 hours)
    a) the elements of serial communication;
    b) Synchronous and asynchronous communication with 8251;
    c) The connection and programming method of 8251.
10. A/D and D/A (3 hours)
    a) The key elements of A/D, and ADC0809;
    b) The key elements of D/A, and DAC0832;
    c) The programming method of D/A and A/D.
11. DMA (2 hours / option in 11 and 12 by student)
    a) The programming methods of DMA;
    b) The programming methods of extended DMA.
12. LED (2 hours / option in 11 and 12 by student)
    a) The key elements of bicolor LED light array;
    b) The programming method bicolor of LED light array with PC.

Grading:

The final grade is listed as follows:

Examination on computer:	30%
Experiment grade:	50%
Experiment reports:	20%

Text & Reference Book:

[1] Zhang Ji and Gao Ping, Computer and network experiments II, 2017

[2] Muhammad Ali Mazidi, Janice Gillispie Mazidi. The 80x86 IBM PC and Compatible Computers: Assembly Language, Design, and Interfacing (Fourth Edition)，Prentice Hall, 2003

[3] David A. Patterson, John L. Hennessy, Computer Organization & Design: The Hardware/Software Interface. 4rd Edition, Morgan-Kaufmann, 2008.

101053376 Labwork of Computer and Networks

Lecture Hours: **0**
Laboratory Hours: **32**
Credits: **1**
Term(If necessary): optional, the second-year of undergraduate period (4th semester) is suggested.
Prerequisite(s): (a) must be taken and passed (b)must be taken (c)be suggested to take first

(a) Fundamentals of Computer Application
(b) None
(c) The principle and technology of computer, Information Network

Course Description:

This course requires the students to master basic principles and techniques of computer and network.

The main topics and structure of the course are based on Curriculum Design of Computer and Networks. Part 1: overall plan of the project, using multimedia and traditional teaching methods to display application of pictures, explain supplemental knowledge, and for classroom discussion; Part 2: Project design report, multimedia and traditional teaching methods are used; Part 3: Project engineering system, case teaching, class Q & A. Part 4: Project presentation, multimedia technology, physical display and discussion.

Course Outcomes:

After completing this course, a student should be able to:

1. Analyze problems and find solutions; design the units (components), systems or processes that meet the specific requirements; test the rationality of the design through the design practice.
2. Model, simulate and solve new complex engineering problems, design innovative experiment acquisition, analyze and deal with data, explore and implement engineering and inspection.
3. Evaluate the impact of engineering and engineering solutions on social, health, safety, legal and cultural aspects of electronic information engineering based on engineering-related background knowledge.
4. Develop the spirit of team work and leadership.
5. Have the ability of interpersonal skills and be able to communicate, compete and cooperate in a cross-cultural context.

Course Content:

Lectures and Lecture Hours:	**0**
Laboratories and Laboratory Hours:	
1.Project overall plan	4
2. Project design report	4
3. Project engineering system	16
4. Project presentation	8

Grading:

Curriculum design report	30%

Electronics Engineering

Curriculum design work	50%
Course design presentation	20%

Text & Reference Book:

[1] Pressman, Zheng Renjie translation. Software Engineering: Practitioners research methods. Beijing: Machinery Industry Press, 2011

[2] Zhang Haifan ed. Introduction to Software Engineering. Beijing: Tsinghua University Press, 2003

[3] Roger S. Pressman. Software Engineering - Practitioners' Research Methods. Beijing: Mechanical Industry Press 2003

[4] Eric J.Braude. Software Engineering - Object-oriented Perspective. Beijing: Electronics Industry Press 2004

[5] Dong Lanfang, Liu Zhenan and other ed. UML curriculum design. Beijing: Mechanical Industry Press, 2004

[6] Wang Yue, Luo Senlin. Information systems and security against the theory (2nd edition). Beijing: Beijing Institute of Technology Press .2015.09

[7] Luo Senlin. Information System Security and Confrontation Technology. Beijing: Beijing Institute of Technology Press .2005.08

[8] Luo Senlin, Wang Yue, Pan Limin. Network information security and confrontation (2nd edition). Beijing: National Defense Industry Press .2015.11

[9] Luo Senlin, Gao Ping, Su Jingxia, Pan Limin. Information system and security confrontation - practice articles (2nd edition). Beijing: Higher Education Press .2016.05

[10] Luo Senlin. Information security and confrontation practice basis. Beijing: Electronic Industry Press .2015.04

[11] Chen Kaijiang translation, Luo Senlin review. Machine learning practical case analysis. Beijing: Machinery Industry Press .2013.04

101054203 Electromagnetic Field Theory and Microwave Engineering

Lecture Hours: **64**
Credits: **4**
Prerequisite(s): **Calculus, Physics I, II, Linear Algebra, Mathematical Equation and Special Functions, Complex Variable Functions and Integration Transformation**

Course Description:

This is an introductory undergraduate level course related to the area of Electromagnetic Theory and Microwave Engineering. Based on the intuitive knowledge from General Physics electromagnetic, the Electromagnetic Theory derives the theory from scratch via advanced mathematics. It covers the fundamental principles of electromagnetism: vector fields, electro- and magneto- statics, electric and magnetic properties of materials, time varying fields, Maxwell's equations, radiation and propagation of electromagnetic waves, and antenna and antenna system design. Based on the knowledge of Electromagnetics, Microwave Engineering provides the essential information which distinguishes a microwave engineer apart from a "normal" electrical engineer. A detailed explanation on the fundamental concepts of Microwave Engineering as well as real life examples will be given. The students will be required to master transmission line theory, microwave network theory, microwave components, microwave circuit design, and microwave measurement techniques.

Course Outcomes:

Outcome 1: Acquire knowledge of EM field theory basic concepts including field theory, static field, time varying field, Maxwell equation; and knowledge of microwave engineering theory including transmission line theory, passive components, and microwave network analysis. Establish basic capability of solving EM field theory and microwave engineering problems.
Outcome 2: Identity EM field theory and microwave engineering problems using advanced mathematics and EM field theory, and describe these problems with mathematical and EM theory methods.
Outcome 3: Acquire EM theory and microwave components' mathematical models, and use advanced mathematical problems to solve such models for viable results. Mastering experimental methods, and results based on mathematical model and theory expectations.
Outcome 4: Understand EM field theory and microwave engineering conventions, regulations, important academic paper sources and indexing sources, lead students to acquire information using such retrieval methods and use them to help analyzing complex problems in electronic and information systems.
Outcome 5: Based on acquisition of EM field theory and microwave engineering knowledge, design components and sub-systems according to engineering practice requirements of EM testing systems and microwave systems.

Course Content:

week	hrs	Chapter and content	Homework
1	4	**Course Introduction and Background Review** Coulomb's, Ampere's, Faraday's Law, Maxwell's Equation Summarize Relationship between ϱ, E, V, D, and I, B, A, H	EM ch1 exercises
2	4	**Vector Algebra, Vector calculus** Gradient, Divergence, Curl Line, Surface, Volume Integral	EM ch1 exercises
3	4	**Electromagnetic induction** Faraday's law, inductance, energy in H-field.	EM 2,3, 4, 5, 6 exercises
4	4	**National holiday**	
5	4	**Time Varying Electromagnetic Field** Displacement current and modification of Ampere's Law, Maxwell's Equation, orthogonal electromagnetic field, dispersion and absorption of media, Poynting's vector, wave equations, scalar potential, vector potential, time varying EM field boundary condition.	EM7
6	4	**Plane wave** General solution of Helmholtz Equation, plane wave, polarization, wave propagation in lossy media, phase velocity, group velocity, reflection and deflection.	EM8
7	4	**Guided wave** Rectangular waveguide, TE10 mode, energy transmission and losses in waveguide, TEM wave on transmission line, resonator cavity.	EM9
8	4	**Radiation of Electromagnetic Wave** Retarded Potential, Hertzian and Magnetic dipole antenna, Line antenna, Directivity and Gain, Antenna Array	EM10
9	4	**Review of Electromagnetic Field Theory**	
10	4	**Transmission Line Theory** TL theory, Transient Signal, Eye Diagram	MW2
11	4	**Transmission Line and Waveguides** Coaxial Line, Microstrip, Stripline, Coplanar, Rectangular WG, Circular WG, Two-wire, Three Conductor Line	MW3
12	4	**Scattering Parameter** Multi-port Network, Normalized Power Waves, Scattering Parameter and Power, S-parameter, Signal Flow Chart, S-parameter measurement	MW4
13	4	**General Introduction to RF, MW, EM Simulation** Numerical methods, Meshing, Boundary Condition, Ports and de-embedding	MW6
14	4	**RF Components and Circuits** TL resonator, Impedance Matching, Filter, TL Filter, Circulator, Power Divider, Branchline Coupler, Rat Race Coupler, Directional Coupler, Balun, Electronic Circuits, RF Design Software	MW7
15	4	**Introduction to Microwave System** Frii's formula, Propagation Models, Noise Figure, Link Budget	MW8

Grading:

Homework:	10%
Quizzes:	20%
Final project:	20%
Final (software):	25%
Final (written):	25%

Text & Reference Book:

Text book:

Hou-min Li, Zhong Chen, Electromagnetic Field Theory, in press.

David M. Pozar, Microwave Engineering (Fourth Edition), Wiley, 2012

Reference:

David K. Cheng. Field and Wave Electromagnetics, (Second Edition), Addison Wesley,Publishing Company 1992.

Daniel Swanson, Wolfgang Hoefer, Microwave Circuit Modeling Using, Field Simulation, Artech House 2003

101054375 Labwork of Electromagnetic Field and Microwave

Lecture Hours: 8
Laboratory Hours: 24
Credits: 2
Prerequisite(s): Mathematical Analysis for Engineering, College Physics, The Theory of Electromagnetic Fields B, Principles of Microwave Technology B. Linear Algebra, Equations of Mathematical Physics & Special Functions, Complex Function and Integral Transform

Course Description:
This course is a professional basic course suitable for electronic information specialty. It will inevitable involve various microwave transmission line and microwave devices in the process of electronic information transmission and processing, especially in the microwave signal transmission and processing. Therefore, future electronic engineer must have the basic knowledge of microwave engineering. In addition, this course is the foundation for the following courses: Antenna Theory and Technology, Electromagnetic Radiation and Transmission, Microwave Electronic Circuit, Microwave Measurement, and Fundamentals of Electromagnetic Compatibility.

Course Outcomes:
After completing this course, a student should be able to:
1. Grasp the method of microwave simulation software operations, microwave passive circuits design and parameter optimization.
2. Master the main processing technological of microwave passive circuit components by means of fabrication.
3. Use the microwave vector network analyzer, grasp the method of microwave passive circuit electric parameter measurement and debugging through physical electrical parameter test.
4. Get hold of the scientific research report writing specifications through the course design report.

Course Content:
Lectures and Lecture Hours:
Microwave simulation software operation 8
- Using typical case to introduce the simulation design process
- Explain the method of software operation
- Teacher tracking guidance

Laboratories and Laboratory Hours:
1. Microwave passive circuit simulation and parameter optimization 12
   - Microwave passive circuit simulation and parameter optimization performed by individual
   - Teachers to answer questions and guidance
   - Design results are confirmed for each student

2. Microwave passive circuit processing and assembly 4
   - Students in group contact processing company to carry out the processing
   - Each student independent completes assembly
   - Teacher tracking guidance
3. Microwave circuit electric parameter measurement and debugging 4
   - Students in group accomplish electric parameter measurement and debugging
   - Teacher tracking guidance
4. Writing course design report 4
   - Students independently accomplish course design report
   - Teacher tracking guidance

Grading:

Simulation Design	50%
Fabrication and Assembly	20%
Microwave Passive Circuit Electric Parameter Measurement and Debugging	20%
Course Design Report	10%

Text & Reference Book:

1. Runqing Yan and Yinghui Li, Principles of Microwave Technology, 4th ed., Beijing: Beijing Institute Technology Press, 2012.

2. Principles of Microwave Technology Course Group, Electromagnetic Field and Microwave Course Design Instruction, 2016.

101055303 Fundamentals of Control Theory

Lecture Hours: 32
Credits: 2
Prerequisite(s): Linear algebra, Differential equation

Course Description:

This course focuses on the analysis and design of systems control. The course will present a clear exposition of the basic principles of frequency- and time-domain design techniques. The classical methods of control engineering are thoroughly covered: Laplace transforms and transfer functions; root locus design; Routh-Hurwitz stability analysis; frequency response methods, including Bode, Nyquist, and Nichols; steady-state error for standard test signals; second-order system approximations; and phase and gain margin and bandwidth. In addition, coverage of the state variable method is significant. Fundamental notions of controllability and observability for state variable models are discussed. Full state feedback design with Ackermann's formula for pole placement is presented, along with a discussion on the limitations of state variable feedback. Observers are introduced as means to provide state estimates when the complete state is not measured.

Course Outcomes:

After completing this course, a student should be able to:

1. Develop mathematical models of single input and single output linear time invariant (LTI) systems using transfer functions and state-space formulation.
2. Analyze time response of LTI systems, such as speed of response, overshoot, steady-state errors.
3. Analyze frequency response of LTI systems, such as stabilities, bandwidth, and sensitivities.
4. Design feedback controller using root-locus, PID and Bode diagram to meet desired system performance specifications.
5. Design state variable feedback systems
6. Use Matlab/Simulink to analyze and simulate system properties.

Course Content:

Lectures and Lecture Hours:

1. Introduction to control systems 1
   - Brief history of automatic control
   - Examples of control systems
   - Control systems design
   - Design examples
2. Mathematical models of systems 2
   - Differential equations of physical systems
   - Linear approximations of physical systems
   - The Laplace transform
   - The transfer function of linear systems
   - Block diagram models
   - Signal-Flow graph models
3. Feedback control system characteristics 1

- Disturbance signals in a feedback control system
- Steady-state error

4.	The performance of feedback control systems	2
	- Performance of second-order systems	
	- The s-Plane root location and the transient response	
	- The steady-state error of feedback control systems	
5.	The stability of linear feedback systems	3
	- The concept of stability	
	- The routh-hurwitz stability criterion	
6.	The root locus method	3
	- The root locus concept	
	- The root locus procedure	
7.	Frequency response methods	3
	- Frequency response plots	
	- Frequency response measurements	
	- Log Magnitude and phase diagrams	
8.	Stability in the frequency domain	6
	- Mapping contours in the s-Plane	
	- The Nyquist criterion	
	- Relative stability and the Nyquist criterion	
	- The Nyquist criterion	
	- System Bandwidth	
	- The stability of control systems with time delays	
	- PID controllers in the frequency domain	
9.	The design of feedback control systems	3
	- Approaches to system design	
	- Cascade compensation networks	
10.	State variable models	3
	- The state variables of a dynamic system	
	- The state differential equation	
	- The transfer function from the state equation	
11.	The design of state variable feedback systems	3
	- Controllability and observability	
	- Full-State feedback control design	
	- Observer design	
12.	Reviews	2

Grading:

Homework	20%
Projects	10%
Final Exam	70%

Text & Reference Book:

Richard C. Dorf, Robert H. Bishop. Modern Control System, 12th ed., 2011, ISBN -13:978-0-13-602458-3.

101055372 Light Level Labworks of Fundamentals of Control Theory

Experiment Hours: **8**
Credits: **0.25**
Prerequisite(s): **C program, Matlab, Linear algebra**

Experiment Description:

These experiments focus on control system modeling and analysis. Each experiment is to explore the principles of system modeling from simple one to complicated one. Varies of system testing tools are presented, including tool of frequency analysis, tool of time domain analysis and tool of z domain analysis. In addition, toolbox of modern control system is presented for state variable models.

Experiment Outcomes:

After completing these experiments, a student should be able to:

1. Design models of single input and single output linear time invariant (LTI) systems using transfer functions and state-space formulation.
2. Testing time response of LTI systems, such as speed of response, overshoot, steady-state errors.
3. Testing frequency response of LTI systems, such as stabilities, bandwidth, and sensitivities.
4. Design feedback controller using control toolbox.
5. Design state variable feedback systems

Experiments and Experiment Hours:

1. Designing control system with Matlab 1
2. -Building the transfer function with Matlab
   -System representation transformation.
   -Equivalent representation of system in different connection (cascade, parallel and feedback).
3. Transient response analysis 1
   -System time domain analysis using Matlab.
   -LTI Viewer tool box
4. Root locus 2
   -Sketching root locus using matlab
   -System analysis using root locus.
5. Frequency characteristic analysis 1
   -System analysis using Nyquist and Bode plot.
   -Frequency domain analysis.
6. System compensation design 1
   -Designing of lead and lag controller
   -System analysis using root locus
   -System analysis using Bode plot
7. Pole assignment and design of full-state feedback 2
   -Understanding state feedback

-Learning and grasping the design method of state observer

Grading:

Experiments 1 and 2	25%
Experiment 3	25%
Experiments 4 and 5	25%
Experiment 6	25%

Text & Reference Book:

Richard C. Dorf, Robert H. Bishop. Modern Control System. 12th ed., 2011, ISBN -13:978-0-13-602458-3.

Brian R.Hunt，Ronald L.Lipsman，Jonathan M.Rosenberg，Kevin R.Coombes，John E.Osborn，and Garret J.Stuck. A Guide to MATLAB for Beginners and Experienced Users. 2001(28), Cambridge University Press.

Matlab official lecture，http://uk.mathworks.com/help/pdf_doc/matlab/getstart.pdf

101056303 Semiconductor Physics and Device Modeling

Lecture Hours: **48**
Laboratory Hours: **0**
Credits: **3**
Prerequisite(s): **College Physics，Fundamentals of Analog Circuits**

Course Description:

The course examines the fundamentals of semiconductor and the models of microelectronic devices for silicon integrated circuit designs. The topics include: Electron state in semiconductors, Carrier statistics in equilibrium, Carrier transport, Non-equilibrium excess carrier, P-N Junction, Metal-semiconductor junction, Metal-insulator-semiconductor structure, Metal-oxide-semiconductor field effect transistor, Bipolar junction transistor. The course emphasizes physical understanding of basic semiconductor concepts and application of device models.

Course Outcomes:

After completing this course, a student should be able to:

1. Describe and explain basic concepts of semiconductor physics and devices: donor and acceptor, majority and minority carrier, drift, diffusion, excess carrier, and so on.
2. Describe and analyze p-n junctions, semiconductor-metal contacts and MIS structures.
3. Describe, explain and analyze the operation of p-n diode, MOSFET and BJT in terms of their physical structure.
4. Describe, explain and analyze the I-V relationship and capacitance effects of p-n diode, MOSFET and BJT in terms of their physical structures
5. Describe, explain and analyze SPICE model of p-n diode, MOSFET in terms of their physical structures.
6. Apply SPICE model of p-n diode, MOSFET in the design and analysis of silicon integrated circuit.

Course Content:

Lectures and Lecture Hours:

1. **Introduction** 1
2. **Electron State in Semiconductors** 5
   - Semiconductor Crystal Structures
   - Energy band: conduction and valence bands
   - Electrons and holes
   - *E* versus *k* for Si,Ge and GaAs
   - Effective mass
3. **Carrier statistics in Equilibrium** 6
   - Intrinsic semiconductor & Extrinsic Semiconductor
   - Carrier concentrations of intrinsic semiconductor in thermal equilibrium
   - Carrier concentrations of extrinsic semiconductor in thermal equilibrium
4. **Carrier Transport** 6

-Thermal motion
-Drift current
-Effects in high electric field
- Diffusion current

5. **Non-Equilibrium Excess Carrier** 4
   -Injection and recombination
   - Continuity equations
   - Recombination
   -Quasi Fermi level
6. **P-N Junctions** 5
   -p-n junction in equilibrium
   - p-n Junction with external bias
   - Capacitances of p-n junction
   -Reverse breakdown
   - SPICE model of p-n junction diode
7. **Metal-Semiconductor Junctions** 4
   -Schottky contacts
   - Ohmic contacts
   - Current-voltage characteristics of SBD
8. **Metal-Insulator-Semiconductor Structures** 5
   - Semiconductor surface
   - Ideal MIS structure in thermal equilibrium
   - MIS structure outside equilibrium
9. **Metal-Oxide-Semiconductor Field-Effect Transistors and Modeling** 8
   - Structure of MOSFET
   - Threshold voltage
   - Current-voltage characteristics for MOSFET
   - Parasitic capacitances of MOSFET
   - SPICE model of MOSFET
10. **Bipolar Junction Transistors** 4
   - Structure of BJT
   - Current-voltage characteristics of BJT
   - SPICE model of BJT

Grading:

Homework	30%
In class Quizzes	10%
Midterm Exams	20%
Final	40%

Reference Book:

[1] D. A. Neamen, "Semiconductor Physics & Devices Basic Principle", 4rd Ed. 2011. （美）尼曼著:半导体物理与器件（第四版）（英文版）

[2] Ben G. Streetman and Sanjay Kumar Banerjee , "Solid State Electronic Devices", 6th Ed,

Pearson Education Inc.2006

[3] Alamo, J. A. "Integrated Microelectronic Devices: Physics and Modeling".2013

[4] S.M.Sze, " Physics of Semiconductor Devices, " 3rd Ed. 2007

[5] Jan M.Rabaey, "Digital Integrated Circuits –A Design Perspective" 2nd Ed. del Alamo,

[6] Fabrizio Bonani, "Noise in Semiconductor Devices: Modeling and Simulation" (Springer Series in Advanced Microelectronics)[Kindle Edition]

101056408 Integrated Circuits Engineering

Lecture Hours: **48**
Laboratory Hours: **40**
Credits: **4.25**
Prerequisite(s): Fundamentals of Analog Circuits, Digital Electronics and Semiconductor Physics and Device Modeling

Course Description:
This course explores the modeling of the very large scale integrated circuit(VLSI) in modern society; analysis of timing and power of the very large scale integrated circuit; study of the classical VLSI design methods using EDA tools, and the development of the analog IC and the digital IC. The current IC design tools will be extensively used in the class, the discussion, and the project.

Course Outcomes:
After completing this course, a student should be able to:
1. Develop mathematical models of the timing and power of very large scale integrated circuit(VLSI).
2. Analyze the parameter of analog IC.
3. Analyze the parameter of digital IC.
4. Design the VLSI circuit, to meet desired system performance specifications.
5. Use the current IC design tools to analyze and simulate system properties.

Course Content:
Lectures and Lecture Hours:
1. Introduction 6
    - the description of CDIO method: Conceive, Design, Implement and operate
    - the history of Integrated Circuit
    - the introduction of IC manufacture process and design flow
2. Fundamental Circuits 8
    - the fundamental cells of digital IC
    - the analysis of timing and power parameters
    - the relationship of IC manufacture process and the parameters of the circuit
3. CMOS OPA 10
    - the design of basic amplify circuit
    - the design of operational amplifier
    - the design of ADC and DAC
4. Fundamental Digital Modules 8
    - the basic design flow of VLSI
    - the layout of VLSI
    - the test and verification of VLSI
5. Sequential Digital Circuits 4
    - the basic design flow of VLSI

- the layout of VLSI
- the test and verification of VLSI

6. Memory	4
- the basic design flow of VLSI	
- the layout of VLSI	
- the test and verification of VLSI	
7. Fundamental of VLSI Design Project	8
- the basic design flow of VLSI	
- the layout of VLSI	
- the test and verification of VLSI	

Laboratories and Laboratory Hours:

1.Simulation of amplifiers and logic gates	8
2. Simulation of OPA	8
3.Design and Simulation of Flash ADC	22
4.The Overview of Semiconductor Market	2

Grading:

Dairy score	5%
Report	5%
Experiment	20%
Exam	70%

Text & Reference Book:

Neil H. E. Weste, CMOS VLSI Design: a Circuit and Systems Perspective, 3th rd., 2006, ISBN 7-5083-3862-6.

101056474 Embedded System Design and Verification

Lecture Hours: 32
Laboratory Hours: 0
Credits: 2.0
Prerequisites: Fundamentals of Digital Circuit, The C Programming Language

Course Description:

This course introduces how to design and implement the embedded system and analyze its performance. Hardware and software architecture of the embedded system, the tool chain and the system performance analysis will be included.

Course Outcomes:

After completing this course, a student should be able to:

1. Comprehend the basic concepts of embedded system
2. Describe the components and operation of a microprocessor based embedded system including the processor, memory, bus and I-O systems.
3. Master the process of assembling, linking, and debugging assembly program.
4. Analyze and design assembly language program, data structures to solve common engineering, mathematical, and business oriented problems.
5. Understand memory system and computer bus.
6. Understand the system program performance analysis
7. Understand the system design method of embedded system.

Course Content:

Lectures and Lecture Hours:

1. Introduction 8
- Course introduction
- Basic architecture of embedded system
- Embedded system design methodology
- Embedded system specification design
- Component selection of embedded system

2. Co-design of Hardware/Software 8
- Processor base system design
- Partition of hardware/software
- Performance evaluation of system

3. Design and implementation of embedded system 12
- Embedded system hardware design and Implementation
- Firmware design and implementation of embedded system
- Design and implementation of embedded operating system
- Design and implementation of embedded system application software
- Integration and optimization of embedded system

4. Design example of embedded system 8

Grading:

Quizzes	10%
Homework	10%
Project presentation	40%
Final Exam:	40%

Text & Reference Book:

Text Book:

1.Jørgen Staunstrup, Hardware/Software Co-Design: Principles and Practice

Reference Book:

1.Wayne Wolf, Computers as components

101057303 Digital Communication Principles

Lecture Hours: 48
Credits: 3
Prerequisite(s): Random signal analysis, Signals and Systems

Course Description:
The course is designed to provide students with a sound fundamental education in the areas of digital communications. The main contents include spectral analysis; random signal theory; information theory; digital transmission through AWGN channels; digital carrier-modulation schemes; error control coding; optimum receivers; carrier and symbol synchronization; multiuser communications.

Course Outcomes:
After completing this course, students should be able to:
1. Understand the fundamental concepts in digital communication systems.
2. Develop the mathematical models of performance analysis and applications of digital communication system.
3. Design typical communication system using the performance analysis methods to meet desired performance specifications.

Course Content:
Lectures and Lecture Hours:

1. Introduction 4
   1.1 Historical Review of Communication
   1.2 Message，Information，and Signal
   1.3 Digital Communication
   1.4 Channel
   1.5 Noise in Channel
2. Deterministic and Random Signal Analysis 4
   2.1 Classification of Signals
   2.2 Characteristics of Deterministic Signals
   2.3 Characteristics of Random Signals
   2.4 Examples of Frequently Used Random Variables
   2.5 Numerical Characteristics of Random Variable
   2.6 Random Process
   2.7 Gaussian Process
   2.8 Narrow Band Random Process
   2.9 Sinusoidal Wave plus Narrow Band Gaussian Process
   2.10 Signal Transfer through Linear Systems
3. Information Theory 2
   3.1 Mathematical Models for Information Sources
   3.2 A Logarithmic Measure of Information
   3.3 Channel Models and Channel Capacity

4. Digitization of Analog Signal 4
   - 4.1 Introduction
   - 4.2 Sampling of Analog Signal
   - 4.3 Quantization of Sampled Signal
   - 4.4 Pulse Code Modulation
   - 4.5 Differential Pulse Code Modulation
   - 4.6 Delta Modulation
5. Representation and Transmission of Baseband Digital Signal 6
   - 5.1 Introduction
   - 5.2 Coding Method of Character
   - 5.3 Waveform of Baseband Digital Signal
   - 5.4 Symbol Code Types of Baseband Digital Signals for Transmission
   - 5.5 Frequency Characteristic of Baseband Digital Signal
   - 5.6 Transmission and Inter-symbol Interference of Baseband Digital Signal
   - 5.7 Eye Pattern
   - 5.8 Time domain Equalizer
6. Digital Modulation System 8
   - 6.1 Introduction
   - 6.2 Binary Amplitude Shift Keying (2ASK)
   - 6.3 Binary Frequency Shift Keying (2FSK)
   - 6.4 Binary Phase Shift Keying (2PSK)
   - 6.5 Binary Differential Phase Shift Keying (2DPSK)
   - 6.6 Performance Comparison of Binary Digital Keying Transmission System
   - 6.7 M-ary Digital Keying
7. Synchronization 4
   - 7.1 Introduction
   - 7.2 Carrier Synchronization Method
   - 7.3 Bit Synchronization
   - 7.4 Group Synchronization
8. Optimum Receiving of Digital Signal 4
   - 8.1 Statistical Characteristics of Digital Signal
   - 8.2 Optimum Receiving Criterion of Digital Signal
   - 8.3 Optimum Receiver for Deterministic Digital Signal
   - 8.4 Symbol Error Probability of Optimum Receiver for Deterministic Digital Signal
   - 8.5 Performance Comparison of Practical Receiver and Optimum Receiver
   - 8.6 Matched Filtering Receiving Principle of Digital Signal
   - 8.7 Optimum Baseband Transmission System
9. Multiplexing and Multiple Access 4
   - 9.1 Introduction
   - 9.2 Frequency Division Multiplexing (FDM)
   - 9.3 Time Division Multiplexing (TDM)
   - 9.4 Code Division Multiplexing (CDM)
   - 9.5 Multiple Access
10. Channel Coding and Error Control 8

10.1 Introduction
10.2 Basic Principles of Error Control Coding
10.3 Performance of Error Correction System
10.4 Parity Check Codes
10.5 Linear Block Codes
10.6 Cyclic Codes
10.7 Convolution Codes

Grading:

Homework	30%
Examination	70%

Text & Reference Book:

Changxin Fan, Principles of Digital Communications, 2nd ed., 2015, ISBN：9787121264238.

101057372 Light Level Labwork of Digital Communication Principles

Lecture Hours: 8
Credits: 0.25
Prerequisite(s): Random signal analysis, Signals and Systems

Course Description:
The course is designed to provide students with a sound fundamental education in the areas of digital communications. The main contents include spectral analysis; digital baseband transmission; digital carrier-modulation schemes; error control coding; multiuser communications.

Course Outcomes:
After completing this course, students should be able to:
1. Understand the fundamental concepts in digital communication systems.
2. Use Matlab software/C language to analyze and simulate system performance.

Course Content:
Laboratories and Laboratory Hours:

1. Performance simulation of baseband transmission	2
2. Performance simulations of error control encoding and decoding	2
3. Performance simulation of OFDM transmission	2
4. Performance simulation of frequency band transmission	2

Grading:
Laboratory Homework 100%

Text & Reference Book:
Changxin Fan, Principles of Digital Communications, 2nd ed., 2015, ISBN：9787121264238.
Yan Zhang, Zesong Fei, Principles of Digital Communication Laboratory Manual.

101057410 Electronic Communication Systems

Lecture Hours: 64
Laboratory Hours: 0
Credits: 4
Prerequisite(s): Principles of Digital Communication, Data Communication and Networking

Course Description:

This is an elective course for the students major in electronics engineering, communication engineering, electronic science and technology. The course is designed to prepare students for modern telecommunication industry. Topics includes: the basic principles and components of Data communication and Internet, Microwave communication, Satellite communication, Telephone communication, Optical communication, Cell-phone and Wireless Communication systems.

Course Outcomes:

After completing this course the students should be able to:
1. Explain Multiplexing and compare FDM, TDM and WDM
2. Understand Modem concepts and wideband modulation
3. Apply different error detection techniques
4. Compare different LAN techniques and Internet protocols
5. Explain Microwave antennas and Microwave system components
6. Understand Satellite orbits and GPS system
7. Compare Telephone system, Facsimile, and Internet telephony
8. Analyze Gain Budget of Optical-Fiber Communication system
9. Compare different wireless technologies
10. Design a wireless communication system based on NI USRP SDR experiment platform

Course Content:

Lectures and Lecture Hours:

1. Introduction to Electronic Communication 2
   - Types of Electronic Communication
   - Electromagnetic Spectrum
   -Survey of Communication Application
2. Multiplexing and Demultiplexing Technology 2
   - Multiplexing Principle
   - Frequency Division Multiplexing, Time Division Multiplexing
   - Pulse Coded Modulation
3. Binary Data Transmission 2
   - Principle of Digital Transmission
   - Modem Concept and Methods
   - Broadband Modem Techniques
   - Error Detection and Correction
4. Introduction to Networking and LAN 2

- Network Fundamentals
- LAN Hardware
- Ethernet LANs

5. Internet Technologies 2
    - Internet Applications
    - Internet Transmission Systems
    - Storage-Area Networks
    - Internet Security
6. Microwave Communication 2
    - Microwave Concepts
    - Microwave Antennas
    - Microwave Applications
7. Satellite Communication 2
    - Satellite Orbits
    - Satellite Communication Systems
    - Satellite Application
    - Global Positioning System
8. Telecommunication Systems 2
    - Telephone System
    - Facsimile
    - Paging System
    - Internet Telephony
9. Optical Communication 4
    - Optical Principles
    - Optical Communication Systems
    - Fiber-Optic Cables
    - Optical Transmitters and Receivers
    - Wavelength Division Multiplexing
    - Passive Optical Networks
10. Cell Phone Technologies 4
    - Cellular Telephone Systems
    - Advanced Mobile Phone Systems (AMPS)
    - Global Mobile System (GSM)
    - Digital Cell Phone Systems
11. Wireless Technologies 4
    - Wireless LAN
    - PAN and Bluetooth
    - ZigBee and Mesh Wireless Networks
    - WiMAX and Wireless Metropolitan-Area Networks
    - Infrared Wireless
    - Radio-Frequency Identification (RFID) and Near-Field Communication (NFC)
    - Ultrawideband Wireless
12. Design a wireless communication system 32
    - Wireless Data Communication System design project

- NI USRP SDR experiment platform

13. Course Review and exam 4

Grading:

Final exam	56%
Class Presentation	3.5%
Tests, homework	10.5%
Group Project	30%

Text & Reference Book:

Louis E. Frenzel Jr., Principles of Electronic Communication Systems, 3th ed. 2008, ISBN 978-007-310704-2, McGraw-Hill Press.

Louis E. Frenzel Jr., Liu Jiakang, Principles of Electronic Communication Systems, 3th ed. (adapted), 2010, ISBN 978-7-302-22360-3, Tsinghua University Press.

101058406 Data Communication and Networks

Lecture Hours: **32**
Laboratory Hours: **0**
Credits: **2**
Term (If necessary):
Prerequisite(s): Data Structure and C/C++ Programing

Course Description:

This course is a required for the Electronics Engineering major. The course focuses on the fundamentals of data communication and networks. It is organized with the TCP/IP model, and lectures are arranged in order of Physical Layer, Data Link Layer, Network Layer, Transport Layer, and Application Layer.

Course Outcomes:

After completing this course, a student should be able to:
1. Have an insight into the rationale of why networks are structured the way they are today;
2. understand the issues facing the designers of next-generation data networks;
3. analyze and solve communication and networks problems.

Course Content:

Lectures and Lecture Hours: total 32 hours

1. Introduction (2 hours)
   a) The content and arrangements of the course
   b) What is data communication and networks?
   c) Key elements of data communication and networks
      i. Node
      ii. Link
      iii. Protocol
      iv. Information
   d) The state-of-the-art and the developing trends of data communication and networks technologies
2. Architecture of computer networks (2 hours)
   a) Networks architecture
   b) Protocol and Hierarchy Principals
   c) TCP/IP model
   d) OSI model
   e) The comparison of TCP/IP and OSI
3. Physical Layer (2 hours)
   a) Data, Signal and Data Representation
   b) Common Transmission Media
   c) Line coding and block coding
   d) Multiplexing
   e) Spreading
4. Switching and Access (2 hours)

a) Circuit/Virtual Circuit Switching
b) Message Switching
c) Package Switching
d) ATM
e) Telephone Network
f) xDSL

5. Data Link Layer (4 hours)
    a) Error detection and correction
    b) Data link control
    c) PPP
    d) Basic data link protocol
6. Ethernet (3 hours)
    a) Standard Ethernet
        i. CSMA/CD
    b) Fast Ethernet
    c) Gigabit Ethernet
    d) VLAN
7. Wireless Network (3 hours)
    a) PAN (Blue tooth)
    b) WiFi and 802.11
        i. CSMA/CA
    c) WiMAX
    d) Cellular telephone
    e) Satellite networks
8. Network Layer (6 hours)
    a) Related issues of network layer designation
    b) Address, address categorization and CIDR
    c) Routing protocol and algorithm
        i. RIP
        ii. OSPF
        iii. BGP
    d) ARP、ICMP and IGMP
    e) DHCP and NAT
    f) VPN
    g) IPv6
9. Transport Layer (4 hours)
    a) Key issues of transport layer
    b) UDP
    c) TCP
    d) Flow control, error control and congestion control
    e) QoS
10. Application Layer (4 hours)
    a) DNS
    b) Email

i. Smtp
ii. POP3 and IMAP

c) Web and HTML

i. URL
ii. HTML and HTTP
iii. XML
iv. Web 2.0 and HTML5

Laboratories and Laboratory Hours: None.

Grading:

Assignments:	20%
Final Examination:	80%

Text & Reference Book:

[1] Behrouz A. Forouzan, Data Communication and Networking, 4th Edition, McGraw-Hill, New York, 2007, ISBN-13: 978-0072967753

107050207 Engineering Innovation Design I

Lecture Hours: **0**
Laboratory Hours: **16**
Credits: **0.5**
Prerequisite(s): **Computer Technologies and Programming,**
Programming Implementation in C

Course Description:
Engineering Innovation Design I-VI is a lab work serials through four-year study of electronics and communications. The course follows the pedagogical concept of CDIO (Conceive Design Implementation and operation). Six projects will be offered by the course covering skills training for software development and hardware development. Engineering Design I is focus on training of software design skills. Each student will act as part of a project team and utilize a variety of multimedia software to creatively design and implement a software project.
Course Outcomes:
After completing this course, a student should be able to:
1. Effectively conceive, evaluate, plan, organize and implement software engineering design projects.
2. Become proficient at practical application of numerous academic concepts.
3. Implement software design projects requiring high level programming skill.

Course Content:
Lectures and Lecture Hours: **4**
Introduction
1. Basic concepts of OOP
2. General GUI programming concepts
3. Basic concepts of network communication

Laboratories and Laboratory Hours: **12**
1. Propose a software design application project.
2. Design, implementation and debug this software application project.
3. Present their solutions

Grading:

Weekly project update presentation	30%
Final presentation	20%
Final software quality	25%
Project report	25%

Text & Reference Book:
罗伯茨. C 程序设计的抽象思维(英文版） programming abstractions in c. 2004-04-01. 机械工业出版社
泰德维尔. 界面设计模式(Designing Interfaces)第 2 版（影印版）. 2011. 东南大学出版社

107050208 Engineering Innovation Design II

Lecture Hours: **0**
Laboratory Hours: **16**
Credits: **0.5**
Prerequisite(s): **Computer Technologies and Programming**
Programming Implementation in C

Course Description:

Engineering Innovation Design I-VI is a lab work serials through four-year study of electronics and communications. The course follows the pedagogical concept of CDIO (Conceive Design Implementation and operation). Six projects will be offered by the course covering skills training for software development and hardware development. Engineering Design II is focus on software engineering practices, case studies and collaboration in engineering projects. It will provide future engineering students with an opportunity to design develop and to build apps using a variety of tools.

Course Outcomes:

After completing this course, a student should be able to:

1. Implement software design projects
2. Apply aesthetics properly in app design.
3. Manage software documents.
4. Present ideas and research results efficiently.

Course Content:

Lectures and Lecture Hours: 4

Introduction

1. GUI programming design
2. Network programming
3. Tools/environment setup
4. How to manage software documents

Laboratories and Laboratory Hours: **12**

1. Propose a software design application; descript the features of this application.
2. Implement proposed application.
3. Present their solutions

Grading:

Weekly project update presentation	30%
Final presentation	20%
Final software quality	25%
Project report	25%

Text & Reference Book:

1.泰德维尔. 界面设计模式(Designing Interfaces)第 2 版（影印版）. 2011. 东南大学出版社

2.Materials publicly available from web.

Electrical Engineering

Educational Objectives

This major aims to cultivate well-grounded, practical, creative and all-round research talents who are well developed in morality, intelligence and physical condition to meet the requirements of national modernization. The students are trained to have the abilities in the aspects of system analysis and integration, system design and operation, research and development, management and decision making in areas of control theory and applications, motion control, process control, detecting techniques, and system engineering.

Core Courses

Fundamentals of Electric Circuits, Analog Electronics, Data Structures and Algorithms, Computer Programming Language, Signal Analysis and Processing, Digital Logic Circuit and CPU, Power Electronics, Power System Analysis, Control Theory I & II, Sensor and Measuring Technology, Electrical Machine and Drive, Computer Controlled Systems.

Program Outcomes

The graduates of electrical engineering program are supposed to possess the following abilities:
Comprehensive knowledge of natural science, humanities and arts;

Ability in engineering applications;

Basic theories and skills of control science and engineering, knowledge of the frontiers of the discipline;

Ability to study, develop and grasp modern industrial process and automatic instruments;

Ability to grasp new knowledge and the sense of innovation.

Duration and Degree

4 years, Bachelor of Engineering in Electrical Engineering

Curriculum

Semester 1			Credits
100930001	大学生心理素质发展	Psychological Quality Development of College Students	0
100320001	体育 I	Physical Education Ⅰ	0.5
100980001	军事理论	Military Theory	1
100980002	军事训练	Military Training	1.5
100230057	知识产权法基础	Introduction to Intellectual Property Law	1
100061101	专业导论	Introduction to Automation and Electrical Engineering	1
100245105	国际英语交流 I	International English Communication I	2
101190003	大学化学 C (全英文)	General Chemistry C	2
101080081	计算机技术与编程（全英文）	Computer Science and Programming	3
100270001	思想道德修养与法律基础	Ideological and Moral Cultivation and Basics of Law	3
102172501	线性代数 A (双语)	Linear Algebra A	3.5
100172103	工科数学分析 I	Mathematical Analysis For Engineering I	6
Total Hours			**24.5**

Semester 2			Credits
100180111	大学物理 I	College Physics I	4
100180116	物理实验 B I	Physics Laboratory B I	1
101080082	C 语言编程实践（全英文）	C Programming Practice	1
101062219	电路分析基础实验 A(全英文)	Electric Circuit Lab A	1
100245106	国际英语交流 II	International English Communication II	2
100270002	中国近现代史纲要	Modern Chinese History	2
101031102	工程制图基础（全英文）	Engineering Graphics Fundamental	2
100270005	人文社会实践	Social Practice	2
101062102	电路分析基础 A（全英文）	Fundamentals of Electric Circuits A	3.5
100172203	工科数学分析 II	Mathematical Analysis for Engineering II	6
100320002	体育 II	Physical Education II	0.5
Total Hours			**25**

Semester 3			Credits
100320003	体育 III	Physical Education III	0.5
101062205	C++程序设计 （全英文）	C++ Programming	2
100062203	模拟电子技术实验 A	Analog Electronic Experiment A	0.75
101180121	大学物理 II	College Physics II	4
100180125	物理实验 B II	Physics Laboratory B II	1
101062101	工程概论（全英文）	Introduction to Engineering	1
100172001	复变函数与积分变换	Complex Variables and Integral Transforms	2
101062103	数据结构与算法设计（全英文）	Data Structures and Algorithms Design	2
100172003	概率与数理统计	Probability Theory and Mathematical Statistics	3
100270003	马克思主义基本原理概论	Introduction to Basic Principles of Marxism	3
100062202	电子工艺实习	Electronic Practice	1
101062104	模拟电子技术基础 A（全英文）	Analog Electronics A	3.5
Total Hours			**23.75**

Semester 4			Credits
100320004	体育 IV	Physical Education IV	0.5
101062106	信号分析与处理（全英文）	Signal Analysis and Processing	3
100062104	工程电磁场（全英文）	Engineering Electromagnetic Field	3
101014003	工程力学 B （全英文）	Engineering Mechanics B	4
100270004	毛泽东思想和中国特色社会主义理论体系概论	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics	4
Elective	文化素质类通识教育课专项	General Education	4
Elective	实践训练通识课专项	Lab Electives	2
Total Hours			**20.5**

Electrical Engineering

Semester 5			Credits
100063211	自动控制理论综合实验	Comprehensive Experiment of Control Theory	0.5
101037303	研究与科技论文写作	Research Methods and Academic Writing	1
100031315	制造技术基础训练	Basic Training of Manufacturing	1
100063210	文献检索	Literature Survey	0.5
100063208	工程认识实习	Engineering Cognition Internship	2
100063209	自动化学科前沿与进展	Lecture on Automation and Electrical Engineering	1
100063212	工程创新设计 I	Engineering Design I	1
101063109	电力电子技术（全英文）	Power Electronics	3
101063110	电力系统分析（全英文）	Power System Analysis	3
101063108	自动控制理论 I（全英文）	Fundaments of Control Theory I	4
101063107	数字逻辑与 CPU （全英文）	Principle of Digital Logic and CPU	5
Total Hours			**22**

Semester 6			Credits
101063113	传感器与检测技术（全英文）	Sensor and Measurement Technology	2.5
101063114	计算机控制系统 （全英文）	Computer Controlled System	2.5
100063218	工程创新设计 II	Engineering Design II	1
101063111	自动控制理论 II（全英文）	Fundaments of Control Theory II	3
101063112	电机及控制（全英文）	Electrical Machine and Drive	5
Total Hours			**14**

Semester 7			Credits
100064229	工程创新设计 III	Engineering Design III	1
100064227	专业实习	Specialized Internship	2
100064228	自动控制系统综合设计	Control System Design	1
100064220	电力系统分析课程设计	Power System Analysis Project Design	1
102064217	电机控制系统设计（双语）	Motor Control System Project	1
Elective	专业教育选修课	Technical Elective	10
Elective	实践选修课	Special Electives (Project)	1
Total Hours			**17**

Semester 8			Credits
100064230	毕业设计（论文）	Graduation Project(Thesis)	12
Total Hours			**12**
Total Credit Hours			**158.75**

Technical Electives — **Credits**

103063118	DSP 原理及应用（研究型）	Principles and Application of Digital Signal Processor	2
100063133	嵌入式系统	Embedded System	2
100063131	模式识别	Pattern Recognition	2
100063124	工程测试技术	Engineering Testing Technology	2
0600007	最优与鲁棒控制（全英文）	Optimal and Robust Control	2
0600003	自动控制中的线性代数(全英文)	Linear Algebra in Automatic Control	2
0600004	线性系统理论（全英文）	Linear System Theory	2
100064151	现场总线技术	Field Bus Technology	2
100064145	机器人控制技术	Technology of Robotic Control	2
102064116	工业数据通信与控制网络（双语）	Industrial Communication and Control Network	2
101064115	决策支持系统(全英文)	Decision Support System	2

Special Electives (Project) — **Credits**

100064219	电机综合测试课程设计	Motor Comprehensive Test Project	1
100063217	智能机器人课程设计	Intelligent Robot Project	1
100064225	优化控制课程设计	Optimal Control Project	1

Course Descriptions

100061101 Introduction to Automation and Electrical Engineering

This course introduces Automation concepts and development history, the application of automation technology, academic frontiers and new achievements, professional training objectives and quality requirements of professional talents, engineering and social, environmental and sustainable development, professional norms, professional curriculum system, undergraduate international exchange, method of study and principle, types and composition of automatic control system, etc.

100062104 Engineering Electromagnetic Field

This course is a fundamental course of electrical engineering or similar. Learning the basic electromagnetic phenomenon rules, the basic qualitative and quantitative analysis method, is the basic requirement for the students majoring in electrical engineering and automation. By way of learning this course, students must have a good grasp of basic concept and basic theory of electromagnetic field and electromagnetic wave. Besides, the students will learn the calculation and analysis methods of electromagnetic field, and be able to solve scientific problems. The course will help the students develop their innovative thinking and logical reasoning ability.

Prerequisite(s): Fundamentals of Electric Circuit Analysis

100062202 Electronic Practice

The course is a one-week intensive course for sophomores whose majors are automation and related majors. In the course, the students study to identify electronic components, such as resistors, capacitors, diodes, ICs, etc., use electrical instruments such as multimeters, oscilloscopes, and power supply, do soldering exercises, construct, solder and debug simple electronic circuit such as 8 way responder, design schematic diagram and PCB for simple electronic circuit. After the class, the students are expected to finish the written report.

100062203 Analog Electronic Experiment A

This course covers basic principles and usage of electronic measure and instruments; testing of dc and ac performance of single-transistor amplifier, effects of circuit parameters on amplification; testing of dc and ac performance of multistage amplifier circuits and negative feedback amplifier circuits, effects of negative feedback on amplifier circuits; realizing the proportion, addition and integral circuits by using operational amplifiers; principles of low-pass, high-pass and band-pass active filters; adjustment of Wien bridge oscillator; design of voltage-controlled function generator; application of integrated voltage regulator; application of EDA in circuit analysis and design.

Prerquisite(s): Fundamentals of Electric Circuit Analysis

100063124 Engineering Testing Technology

This course mainly includes the basic theory and method of testing technology, the components of the test system, static and dynamic characteristics of the testing system, virtual instrument technology, measurement of displacement, force, pressure, flow, temperature, speed and other typical common engineering parameters.

100063131 Pattern Recognition

This course presents an introduction of Pattern Recognition theory and its application. It will tell about the basic conceptions and algorithms in pattern recognition, such as: Feature Space, Training, Classification, Discriminant Function, Bayesian Classification, Data Clustering. Some other contents will also be mentioned just like Syntactic Pattern Recognition and Fuzzy Pattern Recognition.

This course suits the students who were interesting in related area or prepare to do further studying in the second level discipline "Pattern Recognition and Intelligence System". Some knowledge of Probability Theory and Mathematical Statistics is necessary before studying. The lectures will be fascinating because a lot of multimedia materials will be used and cases of application will be introduced. Students should learn to solve practical problems with the knowledge and skills from the class by project based learning.

100063133 Embedded System

This course is to explore the basic theory, design method and application of embedded System, and to make students follow the rapid development of embedded system. The main contents of this course includes the concept and development method of embedded system, ARM architecture, ARM instruction system, LPC2000 microcontroller structure principle and hardware design.

100063208 Engineering Cognition Internship

Students will understand the design, manufacture, assembly, process and application of electrical engineering devices by the perceptual knowledge of visiting the production site of the enterprise, understand the theoretical knowledge and establish the professional concept. At the same time, Engineering Cognition Internship provides the students an opportunity to understand the business management knowledge, the professional nature and the responsibilities of the engineers, and have a touch of the latest technologies, processes and achievements in the professional field, so as to improve the overall quality of college students by Professional ethics education, technical safety education and patriotic education.

100063209 Lecture on Automation and Electrical Engineering

This course introduces the electrical engineering frontier and developments in different research directions. The main task is to help students understand the current situation of fields of electrical engineering so as to broaden their horizon and arouse their enthusiasm for studying. It is the prerequisite for the future courses. Furthermore, it plays a significant role in laying the first stone for works related to Electrical Engineering after graduation, including design, manufacture, operation and maintenance.

100063210 Literature Survey

This course mainly introduces the basic concepts, classification methods and retrieval tools of literature retrieval related to automation specialty. Through theoretical study and a large number of retrieval cases, students can master the basic knowledge and method of literature retrieval, and understand the domestic and international tools and methods of literature retrieval. Also, students can master the methods and skills of literature search to develop their abilities, and improve students' self-learning ability and scientific research ability.

100063211 Comprehensive Experiment of Control Theory

This is a specialized basic course for the students majoring in automation, electrical engineering & automation. It aims to train students the ability of system simulation and skills of system analysis, design and application.

The mission is to enable students to master the system modeling, the basic principle and application of MATLAB/Simulink toolbox. The simulation experiments of time domain analysis and frequency domain analysis could cultivate students' system modeling and simulation analysis ability. The main content is to design practical control system algorithm with step response and sine tracking, to raise the basic ability of system analysis, design.

100063212, 100063218, 100064229 Engineering Design I-III

Engineering Design is a series practice courses based on project, which is the application and upgrade of applied knowledge learned in previous core courses. The series are divided into 3 stages, and arranged in three semesters respectively. The courses start from the junior year, thus the students already accumulated necessary fundamental knowledge for doing a project. The courses provide the students with fundamental skills of engineering design, and the ability to apply the theories of science and engineering to practice. The courses also help the students successfully tackle genuine engineering problems encountered in practice.

100063217 Intelligent Robot Project
Through this course, the students are expected to complete the whole process of a small wheeled intelligent robot system, so as to have the ability of independent analysis and problem solving.
The tasks of this course are to make students master debugging steps and methods of parts and the whole robot system through the design and debugging of a typical intelligent robot, strengthen the training of basic skills, flexibility in the use of the theory to solve practical problems, experimental data analysis and treatment, compilation of curriculum design report.

100064145 Technology of Robotic Control
Robotics is a multidisciplinary and interdisciplinary subject, which covers mechanical discipline, electronics, kinematics, dynamics, control theory, sensing detection, computer technology and ergonomics, and is a combined course of theory and applications.
The course is one of the professional electives of Automatic Control. Through introducing the fundamental knowledge of robotics including modeling, control and planning as well as the design and implementation of the control systems of typical robots with applications, the students could grasp the techniques and theories of mechanism design, kinematics analysis, control and utilization of robots, understand the control principle methods, techniques of some typical kinds of robots, obtain the capabilities of preliminary design and development of robotic application systems, and gradually develop the abilities to innovative design by comprehensively using the fundamental theories and professional knowledge.

100064151 Field Bus Technology
This is an elective technical course for students majoring in electrical engineering and automation. The objective of this course is to familiarize students with the basic principles of field bus, and improve their capacity in using it in the design of automation system. Students are expected to know the basic principles and features of fieldbus, its application, as well as the trend. After introducing some basic information, such as computer network, communication and the OSI reference model, teachers will elaborate respective technical features, communication control chip, interface circuit design as well as field bus control system design and application of typical field bus, including CAN, Profibus, FF, LonWorks and industrial Ethernet. In case studies, teachers will introduce the application of these field bus in industrial process control, automobile control, and building automation, etc. The course has clear focuses and stresses on translating the theory into practice.

100064219 Motor Comprehensive Test Project
This course is a specialized elective, suitable for the students major in automation, electrical engineering and automation. The course combines the control theory and practice, designs the closed-loop controller for DC or AC motor servo system, tests and evaluates the static and dynamic performance of the closed-loop system. The course equips the students with the ability of design and debugging the mechanical systems, lays a good foundation for the future professional work. Through the curriculum design, the students will have the following basic abilities: According to the needs of curriculum design, the corresponding solutions can be put forward through consulting the literatures; Determines the rationality of the program through team discussion and analysis; Have the ability of organizing, management, expression and team work.

100064220 Power System Analysis Project Design
This course is to help the students learn how to design a specific power flow software to analyze the power flow in the power systems. The students are supposed to calculate the equivalent circuits and parameters of the components in the power systems. The power losses on the transmission lines are also required. The design will help the students to know how to divide the complicated power systems, how to calculate the key parameters, how to draw the circuits and

how to simplify the power systems. The students will also learn how to design the data structure for the power flow calculation and how to implement the algorithm to solve the equations. At last, each group should finish a design report on their analysis and the software designed by themselves. The calculation results of a given power system should be handed in.

100064225 Optimal Control Project

This course is a professional practice course towards the students major in automatic, electrical engineering automation majors. Firstly, the students are demanded to formula the Beam&Ball or Inverted Pendulum's mathematic model. Secondly, the students should design an intelligent controller to achieve the controlling for the controlled object. At last, programming should be implemented on Simulink in Matlab platform. Through the course design, students will be equipped with the capabilities of the modeling, design, programming, debugging and implementing in practice control system.

100064227 Specialized Internship

Professional practice is an important practical teaching link for students to apply their expertise to production practice. Through professional practice, it makes students to understand the theoretical knowledge and to obtain practical knowledge and accept the basic engineering and technical training from the production related to the field of electrical engineering, research and engineering practice. To broaden expertise, develop practical hands-on skills and improve problem-solving and problem-analyzing skills by engaging in production and technology development. At the same time, through Graduation Internship Practice to understand the business management knowledge, the professional nature and responsibilities of engineers and professional fields of new technologies, new processes and new achievements. And to improve the overall quality of college students by Professional ethics education, technical safety education and patriotic education.

100064228 Control System Design

This course is a specialized basic course for automation, electrical engineering & automation， to train students the ability of system simulation and skills of system analysis, design and application. The mission is to enable students to master the system modeling, the basic principle and application of MATLAB/Simulink toolbox. The simulation experiments of time domain analysis and frequency domain analysis could cultivate students' system modeling and simulation analysis ability. The main content is to design practical control system algorithm with step response and sine tracking, to raise the basic ability of system analysis, design.

100064230 Graduation Project (Thesis)

Graduation Project (Thesis) is a comprehensive, creative part of teaching practice for undergraduate students. It is a comprehensive summary of the basic theories, professional knowledge and practical skills the students have learned. It is the overall test of the academic performance and practice skills of the students.

101062102 Fundamentals of Electric Circuits A

Ohm's Law, Kirchhoff's Laws, and network element voltage-current relations. Application of mesh and nodal analysis to circuits. Dependent sources, operational amplifier circuits, superposition, Thevenin's and Norton's Theorems, maximum power transfer theorem. Transient circuit analysis for RC, RL, and RLC circuits. Sinusoids and phasors, sinusoidal steady-state analysis, AC power analysis, three-phase circuits, magnetically coupled circuits. Laboratory experiments include analog and digital circuits; familiarization with test and measurement equipment; familiarization with Ohm's Law and Kirchhoff's Laws, familiarization with Computer Simulation of a D.C. Circuit, familiarization with Current and Voltage Divider Rules, familiarization with Superposition and Thevenin/Norton Theorems , familiarization with Frequency Domain Analysis, familiarization with Maximum Power Transfer and Average and RMS Values.

Electrical Engineering

Prerequisite(s): General Physics (I, II)

101062103 Data Structures and Algorithms Design

As an integrated basic course in computer science, this course mainly aims to make students know the goals and significances about data structures. Problem solving via computer involves data processing. Data expression and data processing are the very content of data structures and algorithms design. The primary aims of this course are to teach students how to choose suitable data structure, store structure and its corresponding algorithm for a specific problem solving. Students are expected to learn how to analyze the time cost for an algorithm, and the course learning is also a training process of how to design a complex program. Students are required to be able to write correct and effective algorithm with clear structure for a specific problem solving. Experiments make students go through strict and fundamental training so as to lay a good foundation for their succeeding program design.

This course uses C language as describing tool, researches the data logical structure, store structure and its corresponding algorithm through data abstraction. The basic concept, basic algorithm and algorithm design & implementation are emphasized during the whole teaching process. It helps students with non-computer majors to set up the basic concept about data structure and algorithm design, and it is also an important foundation for succeeding programming course.

Prerequisite(s): Computing Science and Programming, C++ Programming

101062104 Analog Electronics A

This course covers diode, bipolar junction transistor, characteristics of field-effect transistor. Common-emitter amplifier, common-collector amplifier, common-base amplifier, analysis of Q-point, ac parameters analysis (voltage gain, input resistance and output resistance). Analysis of multistage amplifier circuits and differential amplifier circuits. Frequency response of Amplifier circuits. Effects of various negative feedback on amplifiers, estimation of closed loop gain. Virtual short and virtual open in the linear circuits of operational amplifiers. Analysis of various wave generating circuits. Construction and analysis of power suppliers.

Prerequisite(s): General Physics (I, II), Fundamentals of Electric Circuit Analysis

101062106 signal analysis and processing

Signal analysis and processing is an introduction to analog and digital signal processing, a topic that forms an integral part of engineering systems in many diverse areas, including seismic data processing, communications, speech processing, image processing, defense electronics, and automatic control. The course presents and integrates the basic concepts for both continuous-time and discrete-time signals and systems. Signal and system representations are developed for both time and frequency domains, mainly for the LTI systems. These representations are related through the Fourier/Laplace/Z transforms. Matlab will be extensively used in the class, homework, and project. This course can train students' ability of signal analysis, system analysis, and corresponding analysis and calculation ability.

Prerequisite(s): Calculus and Differential Equation (I, II), Fundamentals of Electric Circuit Analysis

101062205 C++ Programming

This is a fast-paced introductory course to the C++ programming language. The course is intended for those with little programming background, though prior programming experience will make it easier. The course is also for those who have previous experience and still need to learn C++-specific constructs and concepts. OOP (Object Oriented Programming) will be the core of the course. After completing this course, a student should be able to: understand and use the fundamental programming concepts of C++; manipulate basic standard C++ facilities, such as strings, vectors and pointers; apply object-oriented approaches to software problems in C++; Write small-scale C++ programs using the above skills; isolate and fix common errors in C++ programs.

Prerequisite(s): Computing Science and Programming

101062219 Electric Circuit Lab A

This course is one of the most important experiment courses of Electrical Specialty in colleges and universities. Students are required to grasp the necessary basic knowledge of circuit analysis before learning this course. The primary content of the "circuit experiments" has a broad background of engineering, which includes analysis of the circuit, exploring and verifying the basic laws as well as analysis methods of electric circuit, playing a significant role in establishing a rigorous scientific attitude and engineering viewpoint of applying theory to reality. The course simultaneously develops scientific thinking skills and capacity of experimental research and scientific induction. Furthermore, through the curriculum, we will reach to the purpose that students could deepen the understanding of essential theoretical knowledge as well as measurement and analysis methods of circuit.

101063107 Principle of Digital Logic and CPU

This course covers principles of binary numbers, digital systems, assembly language programming, and an overview of computer architecture. It provides a background in basic technology areas that are required to understand computer architecture and design.

Prerequisite(s): Fundamentals of Electric Circuit Analysis

101063108 Fundaments of Control Theory I

Modeling of dynamic systems: differential equations models, state space models, block diagram models, signal flow graph models, relationships between the various models. Solving the state equation: similarity transformation, minimal polynomial theory. Analysis of Control system characteristics: transient response, stability, steady state response. Analysis and design of control systems: root locus, frequency responses, and state space, including 180^{o} root locus, 0^{o} root locus, Nyquist Diagram, Bode Diagram, Nyquist Stability Criterion, controllability analysis, observability analysis, canonical forms of the state space representation, decomposition of the state space, observer-based state feedback design.

Prerequisite(s): Calculus and Differential Equation (I, II)

101063109 Power Electronics

Power electronics is to introduce the theory, application and typical topologies in power conversion. The typical switches, the switching circuits, modeling, simulation and analysis will be introduced. This course will provide the students with the basic knowledge of power electronics and will give a conclusion of how to analyze power electronics circuits. This course can help the students obtain the necessary knowledge in machine control and converter design, and the knowledge in this course can meet the needs for renewable generation and power systems.

Prerequisite: Fundamentals of Electric Circuit Analysis, Analog Electronics

101063110 Power System Analysis

Power system analysis is to introduce the basic concept of power system, the components in power system, equivalent circuit of different components, the power flow calculation, the fault calculation, the operation, the control and the stability of power system. This course is essential for students to get an idea of the power system and will provide them with the necessary knowledge needed in power grid operation and control.

Prerequisite(s): Fundamentals of Electric Circuit Analysis, Analog Electronics, Power Electronics

101063111 Fundaments of Control Theory II

Analysis and design of linear discrete-time control systems; tools for analyzing nonlinear systems, such as the describing function and the phase plane methods; Lyapunov stability theory; optimal control systems theory including variation calculus, Euler-Lagrange equation, Pontryagin's minimum principle and Hamilton-Jacobi theory, linear quadratic optimal control systems, Bellman dynamic programming approach.

Prerequisite(s): Control Theory I

101063112 Electrical Machine and Drive
The course is to introduce the theory and control of different machines including DC machines and AC machines. Three types of DC machines and two kinds of AC machines are introduced. The design of current control loop and voltage control loop, vector control, direct torque control, speed sensor-less control and the design of power electronic converters are all analyzed in this course. This course can provide the students with the necessary knowledge in machine control and converter design.

Prerequisite(s): Fundamentals of Electric Circuit Analysis, Power Electronics

101063113 Sensor and Measurement Technology
Concept of sensor, Static characteristics, Dynamic characteristics, Calibration. Resistive sensors, potentiometers, strain gages, signal conditioning for resistive sensors. Reactance variation and electromagnetic sensors, capacitive sensors, inductive sensors, electromagnetic sensors, piezoelectric sensors. Thermoelectric sensors, resistive temperature detector, thermal couple, thermistor. Optical sensors, photodiodes, phototransistor, photoresistors, photovoltaic sensors, position Encoders, fiber-optic sensors, image sensors. Digital and intelligent sensors, microcontroller interfacing, communication systems. Measurement of noise, errors during the measurement process and signal processing.

Prerequisite(s): Control Theory (I, II), Fundamentals of Electric Circuit Analysis

101063114 Computer Controlled System
This course is to guide students practically in combining the fundamental control theory with the microcontroller interface design. This course begins with the A/D and D/A conversion channel interface with microcontroller for control systems. Based on the channel design, PC and microcontroller bus interface, including ISA, PCI and STD-1553B, will be introduced; it also presents the design of discrete PID controller and many practical considerations for the system. Besides, two design methods in continuous domain and discrete domain are discussed respectively, such as root locus plot, frequency response method and state space method. Finally, the practical considerations of EMI for a digital control system are elaborated in detail including grounding, shielding and filtering.

Prerequisite(s): Analog Electronics, Control Theory I, Digital Logic Circuit and CPU

101064115 Decision Support System
A Decision support system is a way to model data and make quality decision based upon it. In another words, decision support systems (DSS) are a class of computerized information system that support decision-making activities. The more information you get from external sources, the better your decision will be. Mostly, decision support systems are designed artifacts that have specific functionality. Five more specific Decision Support System types are included: i) communications-driven system, ii) data-driven system, iii) document-driven system, iv) knowledge-driven system, and v) model-driven system. This course critically examines issues confronting Decision Support Systems (DSS) in the business area. The characteristics and components of DSS are discussed in detail. It is pointed out that work activities that require decision making form a spectrum of problems ranging from structured problem to unstructured problem. DSS development and applications are briefly described.

102064116 Industrial Communication and Control Network
This course is a general introduction on data communication networks and its application in industrial control system, principle of operations, and performance analyses. It includes basic conceptions, hardware, software, components, design, connections of network, as well as the requirement and feature of control network. Some concepts such as the OSI model, topologies,

real-time system and major protocols are also covered. Besides, students will work on some experiments on RS485 communication, CAN bus and Industrial Ethernet for better understanding on the control network. Lectures and experiments will help students master basic knowledge about control network and establish sound values, including pursuing the truth and practice, integrity and profession dedication.

102064217 Motor Control System Project

This course is to design and debug a typical automatic control system which is current-speed double closed-loop DC speed control system. Establish a mathematical model of the system by measuring the parameters of each module of the speed control system. Design current and speed controllers by engineering design method. The current regulator is designed according to a typical type I system, and the speed regulator is designed according to a typical type II system. System meets the fast start, no static, anti-jamming and other performances.

103063118 Principles and Application of Digital Signal Processor

The objective of this course is to familiarize students with the DSP core, system architecture and chip peripheral modules to solve system control problems. Students will be able to develop embedded control systems appropriate for different objectives.
The main topics of course are system architecture and peripheral interface, fix point DSP operation theory and numeric scaling, embedded system development and applications, design of DSP interface circuit, processor expert and software design.

Course Syllabus

100061101 Introduction to Automation and Electrical Engineering

Lecture Hours: 16
Laboratory Hours: 0
Credits: 1
Prerequisite(s): None

Course Description:
This course introduces Automation concepts and development history, the application of automation technology, academic frontiers and new achievements, professional training objectives and quality requirements of professional talents, engineering and social, environmental and sustainable development, professional norms, professional curriculum system, undergraduate international exchange, method of study and principle, types and composition of automatic control system, etc.

Course Outcomes:
After completing this course, a student should be able to:
1. Understand the concept of automation, the development of the industry, the application of automation technology, the academic frontiers and the latest achievements.
2. Understand the goal of professional training and the requirements to the professional personnel.
3. Understand the social responsibility of engineering and its influence to the world.
4. Understand the influence of engineering practice to the environment and social sustainable development.
5. Comply with the engineering ethics and norms.
6. Understand the professional curriculum system, the task of the major and the international exchange program.
7. Grasp the principle and method of study, be interested and arouse the enthusiasm of learning.
8. Build the basic concept of feedback control, understand the type and composition of automatic control system.

Course Content:
Lectures and Lecture Hours:

1. The concept of automation and a brief history of development 1
   - The concept of control and automation
   - Automatic device in ancient China
   - A brief history of control and automation technology development
   - Chinese education, scientific research institutions and academic groups of automation
2. Learning theory and learning methods 1
   - The concept of university to study
   - Learning tasks of automation major students
   - The learning process and the objective principle
3. The application of control and automation technology 4
   - Introduction
   - Machinery manufacturing automation
   - Industrial process automation
   - Electric power systems Automation
   - Aircraft control system

Intelligent building system
Intelligent transportation system
Biological control system
Ecological and environmental control system
The social and economic control system
Large system control and system engineering

4. Professional training objectives and quality requirements	4

Automation and major of automation engineering
The aim of automation major cultivate in our country's university
The engineer's professional nature and responsibility
The engineer's professional ethics
Automation professional career planning
Automation engineering requirements for cultivating talents

5. Automation major teaching arrangement	4

Teaching task and characteristics of the universities
The type of engineering course
Curriculum of automation
The teaching link of automation
The significance of education activities and content
Undergraduate study abroad exchanges
Major of foreign universities Electricial Engineering

6. Prospect of control and automation technology	4

Computer integrated manufacturing system
Application of Robot technology
High-speed trains and space vehicle intelligent control system
Virtual reality technology
Aerospace engineering

7. The type and composition of automatic control system	2

Constant automatic adjustment system
Servo system
The composition of the automatic control system
Automation instrument
Control and computer control system
Automatic control and remote control system
The linear and nonlinear control system

Grading:

In class Quizzes1	10%
In class Quizzes2	10%
In class Quizzes3	10%
Project	70%

Text & Reference Book: N/A

100062104 Engineering Electromagnetic Field

Lecture Hours: 48
Laboratory Hours: 0
Credits: 3
Prerequisite(s): Fundamentals of Electric Circuit Analysis

Course Description:
This course is a fundamental course of electrical engineering or similar. Learning the basic electromagnetic phenomenon rules, the basic qualitative and quantitative analysis method, is the basic requirement for the students majoring in electrical engineering and automation. By way of learning this course, students must have a good grasp of basic concept and basic theory of electromagnetic field and electromagnetic wave. Besides, the students will learn the calculation and analysis methods of electromagnetic field, and be able to solve scientific problems. The course will help the students develop their innovative thinking and logical reasoning ability.

Course Outcomes:
After completing this course, a student should be able to:
1. Analyze the divergence, curl, flux, and circulation of scalar field and vector field.
2. Analyze the intensity of electric field and electric potential of electrostatic field.
3. Use the integral equation and differential equation to calculate and analyze the constant electric field.
4. Calculate and analyze the magnetic flux, magnetic field intensity and magnetic scalar potential of stationary magnetic field.
5. Calculate and analyze the boundary value problems of constant electric field and stationary magnetic field.
6. Use Maxwell equations to analyze frequency response of time-varying electromagnetic field.
7. Use basic equations of plane electromagnetic wave to calculate the transmission characteristics of plane electromagnetic wave in ideal medium.

Course Content:
Lectures and Lecture Hours:

1. Introduction and mathematical basis of field theory 6
    - Vector and vector operations
    - The ordinary specific property of scalar field and vector field
    - Scalar field and gradient of a scalar field
    - Flux and divergence of a vector field
    - Circulation and curl of a vector field
    - High-order differential operations
    - Cylindrical-coordinate system and spherical coordinate system
2. Electrostatic field 10
    - Coulomb's law
    - Electric filed intensity
    - Electric flux and flux density
    - Electric potential
    - Energy stored in an electric field
    - Electric dipoles
    - Conductor dielectrics in an electric field
    - Gauss's law and differential equation
    - Boundary conditions

Indirect solution of electric field
Capacitor and capacitance
Poisson's and Laplace's Equations

3. Steady electric currents 4
Nature of current and current density
Basic equations of steady electric field
Equations of continuity
Boundary conditions for current density
Conductance and resistance

4. Magnetostatics 10
Magnetic flux and density
Magnetic dipole
Magnetic vector potential
Biot-Savart Law
Ampere's force law magnetostatics in vacuum
Magnetic fields in magnetic medium
Magnetic scalar potential
Boundary conditions for magnetic field
Self-inductance and mutual inductance
Energy in magnetic field

5. Time-varying electromagnetic field 6
Motional electromotive force
Faraday' s law of induction
Maxwell's equations and boundary conditions
Poynting theorem and Poynting vector
Time - harmonic electromagnetic field
Quasi-static electromagnetic field
Skin effect, eddy current and proximity effect

6. Plane wave propagation 8
General wave equations
Basic conception of plane wave
Plane wave in an ideal dielectric medium
Plane wave in a conducting medium
Polarization of a wave
Normal incidence of uniform plane waves
Wave transmission in waveguides

7. Electromagnetic radiation and antenna 4
Principles and characteristics of electromagnetic radiation
Radiation of electric dipole
Radiation of magnetic dipole

Grading:

Homework	5%
Inclass Quizzes	5%
Final	90%

Text & Reference Books:

1) B. S. Gurn. *Fundamental Theory of Electromagnetic Field*. China Machinery Press. 2002
2) Kraus.Fleisch. *Electromagnetics with Applications*. 5th edition. Mc Graw-Hill.1999

100062202 Electronic Practice

Lecture Hours: **0**
Laboratory Hours: **32**
Credits: **1**
Prerequisite(s): None

Course Description:
The course is a one-week intensive course for sophomores whose majors are automation and related majors. In the course, the students study to identify electronic components, such as resistors, capacitors, diodes, ICs, etc., use electrical instruments such as multimeters, oscilloscopes, and power supply, do soldering exercises, construct, solder and debug simple electronic circuit such as 8 way responder, design schematic diagram and PCB for simple electronic circuit. After the class, the students are expected to finish the written report.

Course Outcomes:
After completing this course, a student should be able to:
1. Operate electrical instruments and devices.
2. Identify usual electronic components.
3. Weld electronic circuits.
4. Install and test electronic circuits.
5. Design simple circuit and PCB.
6. Write lab reports.

Course Content:
Lecture and experiment Hours:

1. Lecture of related knowledge	4
Welding technologies	
Requirements of welding process	
Common components	
Commonly used instruments	
Altium Designer	
2. Lecture of measurement for electronic components	1
Resistor	
Capacitor	
Diode	
Transistor	
etc.	
3. Welding demonstration of electronic components	1
4. Welding practice of electronic components	6
5. Welding exam of electronic components	2
6. Welding electronic products	6
7. Design of schematic diagram and printed circuit board	10
8. Writing lab report	2

Grading:

Welding practice	20%
Welding quiz	30%
Circuit installation and test	20%

Experiment report	20%
Design of schematic diagram and printed circuit board	10%

Text & Reference Book:

1. Yao Bin, Electronic components and electronic practice and training course, 2009. ISBN 9787111261865
2. Song Xuerui, Electrical and electronic practice course, 3th ed. 2009. ISBN 787811057676
3. Wang Tianxi, Wang Yuming, Yang Xinghua, Electronic process practice, 2013. ISBN 9787121207686
4. Altium Designer operation illustration.

100062203 Analog Electronic Experiment A

Laboratory Hours: **24**
Credits: **1.5**
Prerequisite(s): Fundamentals of Electric Circuit Analysis

Course Description:
This course covers basic principles and usage of electronic measure and instruments; testing of dc and ac performance of single-transistor amplifier, effects of circuit parameters on amplification; testing of dc and ac performance of multistage amplifier circuits and negative feedback amplifier circuits, effects of negative feedback on amplifier circuits; realizing the proportion, addition and integral circuits by using operational amplifiers; principles of low-pass, high-pass and band-pass active filters; adjustment of Wien bridge oscillator; design of voltage-controlled function generator; application of integrated voltage regulator; application of EDA in circuit analysis and design.

Course Outcomes:
By performing three types of experiments, which are verification, design and comprehensive experiment, a student should be able to have the following abilities:
1. Systematically master the fundamental techniques in electronic measures and experiments.
2. Understand the basic principles of electronic instruments and freely use them.
3. Understand the characteristics and parameters of electronic devices and correctly select them.
4. Debug the analog circuits and solve problems of analog circuits independently.
5. Analysis and design of wave generation circuits and power suppliers.
6. Design and develop analog circuits as well as apply analog circuits.

Course Content:
Laboratories and Laboratory Hours:

1. Basic Principles of Electronic Measure and Instruments (Verification Experiment) 2
   - Grasp principles and usage of oscilloscope
   - Grasp principles and usage of function generator and milivoltmeter
   - Measure frequency, period and magnitude of outputs of function generator by using oscilloscope
   - Measure phase by using the scan mode and X-Y mode of oscilloscope
   - Master the structure, properties and usage of the experimental box
2. Single-Transistor Amplifier Circuit (Verification Experiment) 3
   - Master the measure methods of Q-point and mid-frequency voltage gain.
   - Understand the effects of changes of R_b, R_c and R_L on voltage gain and output wave.
   - Master the measure methods of input and output resistance of amplifier circuits.
3. Multistage Amplifier and Negative Feedback Amplifier (Design Experiment) 4
   - Master the method for adjusting and testing the Q-point of multistage amplifier.
   - Measure the voltage gain and bandwidth of two-stage amplifier without feedback.
   - Master the method for measuring the performance of multistage negative feedback amplifier.
   - Measure the voltage gain and bandwidth of two-stage amplifier with feedback.
   - Understand the effects of negative feedback on amplifier.
4. Applications of Operational Amplifier (Comprehensive Experiment) 4
   - Grasp the usage of operational amplifier (uA741) and voltage comparator (LM393).
   - Grasp the principles of proportion, addition and integral circuits composed by operational amplifier.

Grasp the structure and principles of low-pass, high-pass and band-pass active filters.

Grasp the adjustment method of Wien bridge oscillator and measure method of frequency. -

Master properties of hysteresis voltage comparator and measure method of voltage transfer characteristics.

5. Design of Voltage-controlled Function Generator (Comprehensive Experiment) 5

Grasp the principles of voltage-controlled function generator.

Design a voltage-controlled function generator to produce square, triangle and sine waves.

Install and debug the voltage-controlled function generator.

Diagnose the faults or problems possibly occurring in the circuits.

6. Applications of Integrated Voltage Regulator (Design Experiment) 3

Grasp the usage and performance evaluation of integrated voltage regulator (w7800 and w7900).

Know the design of voltage-expanded and current-expanded three-terminal integrated voltage regulator.

7. EDA Experiment 3

Simulation of analog circuits by using Multisim 2001.

EDA is a modern design method that must be mastered by students. In this experiment, students learn how to design and simulate the circuits by using Multisim 2001. Before performing the hardware experiment, the EDA design finished by students must be validated by teachers.

User-defined Experiment

In order to inspire the interest and creative, students can define an experiment by themselves.

Grading:

Experiment Operation	30%
Report	10%
Creativity	20%
Experimental Exam	40%

100063124 Engineering Testing Technology

Lecture Hours: 32
Laboratory Hours: 0
Credits: 2
Prerequisite(s): Analog Electronic Technology, Digital Electronic Technology, Microcomputer Principle and Interface Technology, Sensor and Testing Technology

Course Description:
This course mainly includes the basic theory and method of testing technology, the components of the test system, static and dynamic characteristics of the testing system, virtual instrument technology, measurement of displacement, force, pressure, flow, temperature, speed and other typical common engineering parameters.

Course Outcomes:
After completing this course, a student should be able to:
1. Know how to refer technical material and have the ability of using modern engineering tools in a typical engineering parameters measuring project.
2. Put forward the test plan for the project with consideration of economic, environmental and other factors.
3. Choose the right components, and then analyze, design, calculate, debug circuit; have a sense of innovation and the ability of setting up test system.
4. Measure, analyze and process data correctly, develop measurement software using virtual instrument technology; have the ability of developing and designing, analyzing and solving problems.
5. Manage a project with skills of communication and cooperation; have a professional spirit and seek the truth from the scientific facts.
6. Self-study and think independently.

Course Content:
Lectures and Lecture Hours:

1. Introduction of Testing System 2
   - The composition and structure of testing system
   - The static characteristic of testing system
   - The dynamic characteristics of testing system
2. Virtual instrument technology 6
   - Overview of virtual instrument testing system
   - Virtual instrument graphical programming technology
   - Method of setting up virtual instrument test system
3. Signal conditioning circuit 4
   - Overview of signal disposal technology
   - Analysis of typical signal disposal circuit
   - Modulation and demodulation
   - Design of the filter
4. Measurement of common parameter 4
   - Measurement of Displacement (resistance displacement, raster)
   - Measurement of temperature (SCT temperature sensor, AD590, thermistor, PT100, DS18B20)
   - Measurement of pressure (P53 pressure sensor, SCP pressure sensor)
   - Measurement of flow (liquid flow, gas flow)
   - Measurement of force and weight

   Including:

   1 The use of sensors, meters and collecting cards

2 Complete the design of test system
3 Complete the design of signal conditioning circuit and finish the bread plate circuit implementation
4 Create test system
5 Complete the test software development
6 Complete parameter measurement
7 Measurement processing data and error analysis

Grading:

Self & Mutual Assessment	10%
Design Discussion	10%
Project Acceptance	20%
Project Presentation	10%
Final Exams	10%
Project Report	40%

Text & Reference Book: N/A

100063131 Pattern Recognition

Lecture Hours: **32**
Laboratory Hours: **0**
Credits: **2**
Prerequisite(s): Probability and Statistics

Course Description:
This course presents an introduction of Pattern Recognition theory and its application. It will tell about the basic conceptions and algorithms in pattern recognition, such as: Feature Space, Training, Classification, Discriminant Function, Bayesian Classification, Data Clustering. Some other contents will also be mentioned just like Syntactic Pattern Recognition and Fuzzy Pattern Recognition.
This course suits the students who were interesting in related area or prepare to do further studying in the second level discipline "Pattern Recognition and Intelligence System". Some knowledge of Probability Theory and Mathematical Statistics is necessary before studying. The lectures will be fascinating because a lot of multimedia materials will be used and cases of application will be introduced. Students should learn to solve practical problems with the knowledge and skills from the class by project based learning.

Course Outcomes:
After completing this course, a student should be able to:
1. Understand basic concepts, principles and algorithms in pattern recognition.
2. Analyze real problem of pattern recognition, and propose a reasonable solution.
3. Design and implement a pattern recognition system, and evaluate the results.
4. Communicate and collaborate with teammates to solve a comprehensive engineering problem.
5. Collect information and express orally or in written.

Course Content:
Lectures and Lecture Hours:

1. Introduction 3
    - fundamental concepts of pattern recognition
    - structure of pattern recognition system
    - applications of pattern recognition
2. Linear classifier 6
    - structure and principles
    - perceptron algorithm
    - LMSE algorithm
    - SVM
3. Feature dimensions reduction 3
    - concepts and principles
    - feature extraction
    - feature selection
4. Bayesian classifier 3
    - concepts and principles
    - basic Bayesian classifier
    - training of Bayesian classifier
5. Nearest neighbor classifier 1
    - principles and algorithm
    - error rate of NN and KNN classifier
    - improvement of KNN classifier
6. Data clustering 3

- concepts and characteristics
- algorithms
- evaluation of results

7. Intelligent pattern recognition	6
- ANN classifier	
- Deep learning	
- Fuzzy pattern recognition	
8. Structural pattern recognition	3
- normal concepts	
- formal language theory	
- syntactic pattern recognition	
9. Projects reports	4
- interim report	
- final report	

Grading:

Homework	5%
Inclass Quizzes	20%
Project	35%
Final exam	40%

Text & Reference Book:

R. O. Duda, P. E. Hart, and D. G. Stork. Pattern Classification, 2nd ed., 2001, ISBN: 978-0-471-05669-0.

Sergios Theodoridisd. Pattern Recognition, 4th ed.,2008, ISBN: 978-1-59749-272-0.

J.P.Marques. Pattern Recognition, 2001, ISBN: 978-3-642-56651-6.

100063133 Embeded System

Lecture Hours: **32**
Laboratory Hours: **4**
Credits: **2**
Prerequisite(s): Dynamics

Course Description:
This course is to explore the basic theory, design method and application of embedded System, and to make students follow the rapid development of embedded system. The main contents of this course includes the concept and development method of embedded system, ARM architecture, ARM instruction system, LPC2000 microcontroller structure principle and hardware design.

Course Outcomes:
After completing this course, a student should be able to:
1. Determine the software and hardware selection of embedded system in engineering application
2. Analyze and design the embedded system in engineering application
3. Design the scheme of embedded system, the minimum system and common hardware system.
4. Use the embedded development simulation system to realize embedded system software and hardware debugging

Course Content:
Lectures and Lecture Hours:

1. Introduction of the Embedded System	2
- embedded system	
- embedded processor	
- embedded operation system	
2. ARM architecture	8
- Overview	
- ARM7TDMI	
- ARM7TDMI modules and internal block diagrams	
- The data type directly supported by the architecture	
- Processor state	
- Processor mode	
- Internal processor register	
- Current Program Status Register	
- Abnormal	
- Interrupt latency	
- Reset	
- Memory and memory mapping I/O	
- Description of addressing mode	
- Overview of ARM instruction system	
- Coprocessor interface	
- Introduction to debug interface	
- Introduction to ETM interface	
3. ARM7TDM instruction system	4
- ARM processor addressing mode	
- Instruction set introduction	
4. LPC2000 hardware structure	8
- Overview	

- Pin assignment
- Memory addressing
- System control module
- Memory accelerate module
- External memory controller
- Pin connection module
-Vector Interrupt Controller
-GPIO
-UART0
-UART1
-I2C
-SPI
-Timer 0/1
-PWM
-A/D converter
- Real time clock
- Watch Dog

5. Interface technology and hardware design 6
   - The minimum system
   - Inside peripheral
   - Bus interface
   - Other peripheral

Laboratories and Laboratory Hours:

1. Development systems and integrated development environment operations
2. GPIO test and debugging

Grading:

Homework	10%
Inclass Quizzes	10%
Laboratory	10%
Final	70%

Text & Reference Book:

Zhou ligong, ARM embedded system basic course [M]. Beijing: Beijing university of aeronautics and astronautics press, 2003

100063208 Engineering Cognition Internship

Lecture Hours: 0

Laboratory Hours: 16

Credits: 1

Course Description:

Students will understand the design, manufacture, assembly, process and application of electrical engineering devices by the perceptual knowledge of visiting the production site of the enterprise, understand the theoretical knowledge and establish the professional concept. At the same time, Engineering Cognition Internship provides the students an opportunity to understand the business management knowledge, the professional nature and the responsibilities of the engineers, and have a touch of the latest technologies, processes and achievements in the professional field, so as to improve the overall quality of college students by Professional ethics education, technical safety education and patriotic education.

Course Outcome:

After completing this course, a student should be able to:

1. Obtain professional knowledge of the field, strengthen the professional sense, have a clear learning direction and plan career development.
2. Establish perceptual knowledge of the manufacturing process of components, assembly, testing and equipment production.
3. To develop engineering awareness, engineering concepts, engineering ideas and engineering literacy, and understand the basic methods of researching and practical problems solving.
4. Perceive corporate culture and society, have cooperating and hard-working spirit, and get a sense of mission and responsibility for social progress and economic development.
5. Comply with the technical specifications, supervision rules, regulations and laws on safety production.
6. Preliminarily understand the development status, new technologies, new products and prospects in the professional field.
7. Understand the impact of engineering practice on social, environmental protection and sustainable development.
8. Understand the basic situation of enterprise operation and management.

Course Contents：

1. Overview of the industry: the development and trend, the research, and the frontier, etc. so as to let the students have an understanding of the profession.
2. Through practical applications, equip the students with the basic knowledge, the technologies, the development, and the frontier researches in the automation and electrical engineering.
3. Introduce the employment situation in the recent years, guide the students on career planning and job application.
4. On-site teaching by organizing students to laboratories.

Grading:

Homework and Inclass Quizzes	20%
Experimental results	20%
Final	60%

100063209 Lecture on Automation and Electrical Engineering

Lecture Hours: 16
Laboratory Hours: 0
Credits: 1
Prerequisite(s): None

Course Description:
This course introduces the electrical engineering frontier and developments in different research directions. The main task is to help students understand the current situation of fields of electrical engineering so as to broaden their horizon and arouse their enthusiasm for studying. It is the prerequisite for the future courses. Furthermore, it plays a significant role in laying the first stone for works related to Electrical Engineering after graduation, including design, manufacture, operation and maintenance.

Course Outcomes:
After completing this course, a student should be able to:
1. Grasp engineering concepts and the basic electrical engineering researching methods.
2. Grasp the learning methods and know how to integrate theory with practice.
3. Know the current situation and the development of Electric Machines and Electric Apparatus.
4. Know the current situation and the development of Electrician Theory and New Technology.
5. Know the current situation and development of the renewable resources.
6. Know the current situation and development of Power Electronics.
7. Know the current situation and development of Air-Sky servo system.

Course Content:
1.Introduction
1.1 Synopsis of frontier and developments of Electrical Engineering and concepts & thought of engineering.
1.2 Education objectives and diathesis requirement
1.3 Introduction of practice and innovation methods
1.4 How to plan future studying
2.Current situation and development of Electric Machines and Electric Apparatus
2.1 AC motor servo system
2.2 Special micro-motor system
2.3 Switch Reluctance Motor servo system
2.4 Hybrid excited motor servo system
2.5 Brushless DC motor system
2.6 permanent magnet synchronous motor servo system
2.7 Motor's electromagnetic field analysis and numerical computation
3.Research status and progress in the field of electrician theory and new technology
3.1 Network theory and electromagnetic field technology
3.2 Theory of power quality analysis
3.3 Advanced sensing and detection technology
3.4 Electronic new technology

3.5 Image processing and information fusion technology
3.6 Remote power supply technology
3.7 Active filtering technology
3.8 Induction heating technique
4.Research status and progress of new energy field
4.1 Wind power generation and capacity prediction technology
4.2 Solar power generation and photovoltaic grid technology
4.3 Fuel cell power generation technology
4.4 Distributed generation and micro-grid technology
4.5 New power storage system transformation and equalization technology
5. Research status and progress of power electronics and power transmission
5.1 History of power electronic devices
5.2 Study on the evolution mechanism of power electron topology
5.3 Switching power supply and power supply system
5.4 Power conversion technology and application
5.5 The application of power electronic technology in engineering field
5.5.1 Power electronics in information technology
5.5.2 Electric power electronics technology in transportation
5.5.3 Power electronics technology in military industry
5.5.4 Power electronics technology in new energy
5.5.5. Power electronics in industrial applications
6.The Air-Sky servo system and spacecraft maneuvering tracking control
6.1 The Air-Sky servo system
6.1.1 Application field and function of the air - sky servo system
6.1.2 The characteristics of the air - sky servo system
6.1.3 The application status of the air - sky servo system
6.1.4 The development trend of air - sky servo system
6.2 Maneuvering tracking control of spacecraft
6.2.1 Spacecraft attitude control
6.2.2 Spacecraft attitude determination
6.2.3 The spacecraft posture maneuver
6.2.4 Attitude maneuver control method

Grading:

Report	100%

Text & Reference Book: **N/A**

100063210 Literature Survey

Lecture Hours: 16
Laboratory Hours: 0
Credits: 1
Prerequisite(s): Computer Basis

Course Description:
This course mainly introduces the basic concepts, classification methods and retrieval tools of literature retrieval related to automation specialty. Through theoretical study and a large number of retrieval cases, students can master the basic knowledge and method of literature retrieval, and understand the domestic and international tools and methods of literature retrieval. Also, students can master the methods and skills of literature search to develop their abilities, and improve students' self-learning ability and scientific research ability.

Course Outcomes:
After completing this course, a student should be able to:
1. Understand the ways of obtaining scientific and technical documents.
2. Master the methods of obtaining scientific and technical documents.
3. In view of a subject, use literature retrieval method to find information related to the subject, and quickly understand the content of the subject.
4. Master the methods and ways of obtaining scientific and technical documents in English.
5. Master the information collection, sorting, processing and utilization capacity of the document.
6. Master the method of writing scientific papers.

Course Content:
Lectures and Lecture Hours:

1. Introduction 1
    The significance of scientific and technical literature retrieval
    Basic concepts of information, knowledge, information, and documentation
    Types and characteristics of scientific and technical documents
2. Basic knowledge of scientific and technical literature retrieval 2
    Principles of scientific and technical literature retrieval
    Science and technology literature retrieval tool
    Ways, methods, techniques and steps of scientific and technical literature retrieval
3. Book literatures and its retrieval 1
    Summary
    Chinese books and their retrieval
    Foreign language books and their retrieval
4. Periodical literature and its retrieval 3
    Summary
    Chinese periodical literature and their retrieval
    Foreign language periodical literature and their retrieval
5. Patent search 1
    What is a patent?
    Types and utilization of patent documents
    Retrieval of patent documents at home and abroad
6. Dissertations, conference papers and scientific and technical reports and their searches 3

Dissertation and its retrieval
Conference literature and its retrieval
Science and technology report and its retrieval

7. Important retrieval tools abroad 2

American <Engineering Index> and its retrieval
American <Science Citation Index> and its retrieval
Other professional search tools

8. Retrieval and utilization of network information resources 1

Introduction of network information resources
Network information retrieval tools
Network information retrieval strategy

9. Reconstruction of information resources - Scientific Writing 2

Types of academic papers
Characteristics of academic papers
Preparatory work for academic paper writing
Writing requirements for academic papers
Writing skills for academic papers
Academic norm

Grading:

Inclass work	10%
Retrieve job 1	10%
Retrieve job 2	10%
Retrieval report	70%

Text & Reference Book:

Wang Licheng. Retrieval and utilization of scientific and technical literature，4th ed., 2006, ISBN 978-7-5641-2297-3.

100063211 Comprehensive Experiment of Control Theory

Lecture Hours: **12**
Laboratory Hours: **20**
Credits: **2**
Prerequisites: Control Theory, Microcomputer Principle and Interface Technology, C++

Course Description:
This is a specialized basic course for the students majoring in automation, electrical engineering & automation. It aims to train students the ability of system simulation and skills of system analysis, design and application.
The mission is to enable students to master the system modeling, the basic principle and application of MATLAB/Simulink toolbox. The simulation experiments of time domain analysis and frequency domain analysis could cultivate students' system modeling and simulation analysis ability. The main content is to design practical control system algorithm with step response and sine tracking, to raise the basic ability of system analysis, design.

Course Content:
Chapter 1 Basic Knowledge of System Modeling **2**
1.1 The mathematical model of the vehicle movement system
1.2 The mathematical model of the two- level tank system
1.3 The basic structure of control system
Chapter 2 Application of Simulink in System Simulation **4**
2.1 Basic knowledge of Simulink
2.1.2 Commonly Used Blocks of Simulink
2.1.1 Toolbox Module of Simulink
2.2 Application of Simulink in System Simulation
2.2.1 Response analysis of typical input signal in time domain
2.2.2 Response analysis in frequency domain
2.3 Modeling and simulation of DC-motor dual closed-loop control system
2.4 Nonlinear system analysis and simulation experiment
Chapter 3 Experiment of Controller Design Simulation **4**
3.1 Design experiment of PID controller
3.1.1 Overview of PID controller
3.1.2 Proportional (P) controller
3.1.3 Integral (I) controller
3.1.4 PI controller
3.1.5 PD controller
3.1.6 PID controller
3.2 PID controller parameter setting experiment
3.2.1 Ziegler-Nichols method
3.2.2 Critical oscillation method
3.2.3 Controller tuning based on attenuating curve
3.2.4 Experience piece-try method
3.3 Fuzzy control system experiment
Chapter 4 Electro-Hydraulic Servo Control System **2**
4.1 Basic knowledge of electro-hydraulic servo control system
4.2 Mathematical model of electro-hydraulic servo control system
Chapter 5 Proportional valve-controlled hydraulic cylinder system experiment **20**
5.1 Step response experiment
5.1.1Design of controller software
5.1.2 Analysis of result & system performance
5.2 Sinusoidal tracking experiment
5.2.1Design of controller software

5.2.2Design of controller software

Grading:

Design& Discussion	10%
MATLAB Simulation	20%
Project Acceptance	20%
Project Presentation	20%
Project Report	30%

Text & Reference Book:

［1］张袅娜. 控制系统仿真[M]..北京：机械工业出版社，2014.
［2］薛定宇. 控制系统仿真与计算机辅助设计[M].北京：机械工业出版社，2009.

100063212, 100063218, 100064229 Engineering Design I-III

Laboratory hours: **48 (16x3)**
Course Credits: **3 (1x3)**

Course Description:
Engineering Design is a series practice courses based on project, which is the application and upgrade of applied knowledge learned in previous core courses. The series are divided into 3 stages, and arranged in three semesters respectively. The courses start from the junior year, thus the students already accumulated necessary fundamental knowledge for doing a project. The courses provide the students with fundamental skills of engineering design, and the ability to apply the theories of science and engineering to practice. The courses also help the students successfully tackle genuine engineering problems encountered in practice.

Course Outcomes:
After completing the courses, the students should be able to:
- Apply the knowledge and skills they learned to solve the practical engineering problems, such as circuit design, mechanical design, program development, using instruments to test and debug;
- Use the objects in laboratory to imitate the engineering problems and solve the problems with theoretical knowledge;
- Analyze and solve engineering problems independently;
- Develop spirit of team work and leadership;
- Understand how to manage a project;
- Give presentation and demonstration on the observing;
- Write paper in an academic way.

Course Content:
Every 2 to 5 students will form a group and each group has a supervisor. Projects are generally customized or generated from supervisor's research, which are relevant with the industry, science and technology. Projects cover basic knowledge such as mathematics, physics, analog electronic technology, digital electronic technology, micro-computer principle and interface, single chip design and etc. together with automatic control principles. The students will apply the theoretical knowledge to the practical works so as to accomplish their projects.

Grading:

Design& Discussion	20%
Project Presentation	30%
Project Report	50%

100063217 Intelligent Robot Project

Lecture Hours: **0**
Laboratory Hours: **16**
Credits: **1**
Prerequisite(s): Computer Control System, Automatic Control, Sensor

Course Description:
Through this course, the students are expected to complete the whole process of a small wheeled intelligent robot system, so as to have the ability of independent analysis and problem solving.
The tasks of this course are to make students master debugging steps and methods of parts and the whole robot system through the design and debugging of a typical intelligent robot, strengthen the training of basic skills, flexibility in the use of the theory to solve practical problems, experimental data analysis and treatment, compilation of curriculum design report.

Course Outcomes:
After completing this course, a student should be able to:
1. Use engineering design method to make in-depth analysis of the research topic, put forward the design scheme and feasibility demonstration of intelligent robot control system.
2. Complete the construction and commissioning of intelligent robot system according to the system design scheme.
3. Complete the intelligent robot system test according to the subject requirements, and analyze the experimental results.
4. Write the curriculum design report and complete the research summary according to the requirements of scientific document format.

Course Content:
Lectures and Lecture Hours:
Laboratories and Laboratory Hours:

1. Overview of the intelligent robot system	2
- Intelligent robot experiment suite	
- Intelligent robot theory	
- Typical intelligent robot system design method	
2. Project design and demonstration	2
- Determination of topics, feasibility demonstration	
2. Construction and debugging of Robot system	10
3. Analysis and summary of test results	2

Grading:

Homework	10%
Project design report and defense	20%
System commissioning and acceptance	50%
Project Report	20%

Text & Reference Book:
Robotics with the Boe-Bot[M]， Parallax Inc.

100064145 Technology of Robotic Control

Lecture Hours: **32**
Laboratory Hours: **0**
Credits: **2**
Prerequisite(s): **Linear Algebra Automatic Control**

Course Description:

Robotics is a multidisciplinary and interdisciplinary subject, which covers mechanical discipline, electronics, kinematics, dynamics, control theory, sensing detection, computer technology and ergonomics, and is a combined course of theory and applications.

The course is one of the professional electives of Automatic Control. Through introducing the fundamental knowledge of robotics including modeling, control and planning as well as the design and implementation of the control systems of typical robots with applications, the students could grasp the techniques and theories of mechanism design, kinematics analysis, control and utilization of robots, understand the control principle methods, techniques of some typical kinds of robots, obtain the capabilities of preliminary design and development of robotic application systems, and gradually develop the abilities to innovative design by comprehensively using the fundamental theories and professional knowledge.

Course Outcomes:

After completing this course, a student should be able to:

1. Master the definition and classification of robot
2. Use the kinematics theory to analyze kinematics characteristics of robot
3. Use the dynamics theory to analyze dynamics characteristics of robot
4. Design controller for typical robot
5. Achieve the robot perception and intelligent information processing
6. Complete the design of robot motion mechanism and intelligent decision
7. Cultivate professional sprit for students when facing a new challenging problem

Course Content:

Lectures and Lecture Hours:

1. Introduction to Robots	4
Concepts, development history and direction of robots	
Classification and application of robots	
2. Motion of Manipulator	8
Representation of the motion of the manipulator	
Relationship between the position of the gripper and the joint variables	
Jacobian matrix	
Relationship between the gripper force and the joint force	
3. Control of Manipulator	8
Composition of the robot systems	
Transfer function and block diagram	
PID control	
Position control of manipulator	
Force control of manipulator	
4. Sensors of Robots	4
Characteristics and classification of sensors for robots	
Structure principle of internal sensor of robots	

Structure principle of external sensor of robots

5. Environment Recognition of Robots	4
Basic principle of robot vision systems	
Image generation model of camera	
Examples of robot vision systems	
6. Motion and Control of Robots	2
Mobile mechanism	
Motion detection	
Motion control	
7. Intellectualization of Robots	2
Path planning in joint space	
Path planning in Cartesian space	

Grading:

Homework	10%
Inclass Quizzes	20%
Final	70%

Text & Reference Book:

Robotic Engineering , ISBN：9787030089434, 703008943X

100064151 Field Bus Technology

Lecture Hours: **28**
Laboratory Hours: **4**
Credits: **2**
Prerequisite(s): Foundation of network communication; Digital circuit technology

Course Description:

This is an elective technical course for students majoring in electrical engineering and automation. The objective of this course is to familiarize students with the basic principles of field bus, and improve their capacity in using it in the design of automation system. Students are expected to know the basic principles and features of fieldbus, its application, as well as the trend. After introducing some basic information, such as computer network, communication and the OSI reference model, teachers will elaborate respective technical features, communication control chip, interface circuit design as well as field bus control system design and application of typical field bus, including CAN, Profibus, FF, LonWorks and industrial Ethernet. In case studies, teachers will introduce the application of these field bus in industrial process control, automobile control, and building automation, etc. The course has clear focuses and stresses on translating the theory into practice.

Course Outcomes:

After completing this course, a student should be able to:
1. Understand Layered Architecture of networks and basic conceptions of communication and networks.
2. Analyze criteria of communication and network, such as performance, reliability and security.
3. Design protocol for multi node communication.
4. Design CAN bus system for multi node communication.
5. Integrated design for control networks.

Course Content:

Lectures and Lecture Hours:

1. Overview of Fieldbus Technology	2
Brief introduction of Fieldbus Technology	
Development of Fieldbus Technology	
2. Network and communication base	4
Communication data coding	
Serial communication base	
Fundamentals of signal transmission	
Transmission error control	
3. Control network and network interconnection	4
Control network and computer network	
Network topology	
Network interconnection	
Network transmission media	
Access control of network transport media	
Internetworking equipment	
4. Foundation Fieldbus(FF)	4
Communication reference model and data coding of H1	
Communication scheduling of H1	

Network and system management

Function block

5. Industrial Ethernet 4

Brief introduction of industrial Ethernet

TCP/IP protocol group

Real time Ethernet

6. Controller Area Network 4

Introduction

CAN Technology Basics

CAN controller SJA1000

CAN-Based Upper Layer Protocols

7. Special Topics 6

Real-Time Systems

Network-Based Control

Fieldbus

Industrial Ethernet

Laboratories and Laboratory Hours:

1. CAN bus experiment 2
2. Industrial Ethernet experiment 2

Grading:

Homework and Exercise in class	20%
Experiments	20%
Final exam	60%

Text & Reference Book:

阳宪惠 主编. 网络化控制系统—现场总线技术第 2 版［M］. 北京：清华大学出版社，2014.

Supplementary Texts & References

Bogdan M. Wilamowski, J. David Irwin. Industrial Communication Systems.CRC Press, 2011.

CAN Specification. Version 2.0. Robert Bosch GmbH, 1991.

Data sheet of SJA1000 Stand-alone CAN controller. Philips Semiconductors, 2000.

100064219 Motor Comprehensive Test Project

Lecture Hours: **0**
Laboratory Hours: **16**
Credits: **1**
Prerequisite(s): Computer control systems

Course Description:

This course is a specialized elective, suitable for the students major in automation, electrical engineering and automation. The course combines the control theory and practice, designs the closed-loop controller for DC or AC motor servo system, tests and evaluates the static and dynamic performance of the closed-loop system. The course equips the students with the ability of design and debugging the mechanical systems, lays a good foundation for the future professional work. Through the curriculum design, the students will have the following basic abilities: According to the needs of curriculum design, the corresponding solutions can be put forward through consulting the literatures; Determines the rationality of the program through team discussion and analysis; Have the ability of organizing, management, expression and team work.

Course Outcomes:

After completing this course, a student should be able to:
1. Know the basic composition, working process and principle of the motor servo system.
2. Master the modeling method of motor control system based on data, and verify the rationality of the model.
3. Realize the control algorithm and theory with motor closed loop control system.
4. Master the application of DSP and CAN bus communication in control system.
5. Analyze and evaluate the static and dynamic performance of control system in time domain and frequency domain.
6. Design the project scheme according to the curriculum requirements.
7. Choose reasonable and feasible implementation plan according to their own capabilities and practical conditions,
8. Have team work ability, to complete the project work effectively with the team members via communication and cooperation.
9. Have the ability of project management, can make reasonable division of labor, and manage the task progress.
10. Illustration the project results through the actual experiment, and write the curriculum design report.

Course Content:

Lectures and Lecture Hours:

1. Prepare knowledge 1

 to explain the content and requirements of course design, make a brief review of the knowledge points used in course design;
 to introduce the composition and use of the motor servo control system;
 group.

2. Program development 1

 design the program according to the curriculum design requirements;
 combined with your own capacity and realistic conditions, choose a reasonable and feasible implementation plan;
 a clear division of the specific staff of the group;

to find the existence of the lack of knowledge points, then make learning plans.

3. Modeling of Motor-Based Control System Based on Data 4

the static and dynamic characteristics of the motor actuator in the time domain and frequency domain;

modeling based on step response data;

modeling based on amplitude-frequency characteristic data.

4. Closed-loop control system design 4

learn to master DSP programming, CAN bus communication applications;

according to the model, complete the motor control system closed-loop control;

observe the response of the closed-loop control system under different reference signal types.

5. Characteristic test of closed-loop control system 6

step response test;

frequency domain characteristic test, draw the closed-loop system bode diagram;

variable load condition, closed-loop control system characteristic test.

6. Prepare the course design report

Grading:

Project illustration	30%
Project report	70%

Text & Reference Book:

[1] Motor servo system control and performance test course design. teaching material

[2] Zhang Yuhe, Dong Ning. Computer Control System [M]. Beijing, Beijing Institute of Technology Press, 2002.

100064220 Power System Analysis Project Design

Lecture Hours: 16
Laboratory Hours: 0
Credits: 1
Prerequisite(s): Power system analysis

Course Description:

This course is to help the students learn how to design a specific power flow software to analyze the power flow in the power systems. The students are supposed to calculate the equivalent circuits and parameters of the components in the power systems. The power losses on the transmission lines are also required. The design will help the students to know how to divide the complicated power systems, how to calculate the key parameters, how to draw the circuits and how to simplify the power systems. The students will also learn how to design the data structure for the power flow calculation and how to implement the algorithm to solve the equations. At last, each group should finish a design report on their analysis and the software designed by themselves. The calculation results of a given power system should be handed in.

Course Outcomes:

After completing this course, a student should be able to:
1.Develop models of power systems and calculate the parameters.
2.Design a power flow calculation software.
3.Estimate the power loss of the power system and find the solutions.
4.Finish an academic report about the design.

Course Content:

Lectures and Lecture Hours:

1. Introduction	2
- The concept of power systems	
- The power flow calculation algorithm	
- The solution based on Matlab	
- The analysis of the power flow calculation results	
2. Development on computers	14
- Assign the tasks	
- Software development	
-Analysis and estimation	
- Design and report	

Grading:

Project & report	100%

Text & Reference Book:

[1] Power system analysis. Hadi Saadat, 2011.

100064225 Optimal Control Project

Lecture Hours: 0
Laboratory Hours: 16
Credits: 1
Prerequisite(s): Automation Control Theory, Intelligent Control Theory, Self-adaptive Control Theory

Course Description:
This course is a professional practice course towards the students major in automatic, electrical engineering automation majors. Firstly, the students are demanded to formula the Beam&Ball or Inverted Pendulum's mathematic model. Secondly, the students should design an intelligent controller to achieve the controlling for the controlled object. At last, programming should be implemented on Simulink in Matlab platform. Through the course design, students will be equipped with the capabilities of the modeling, design, programming, debugging and implementing in practice control system.

Course Outcomes:
After completing this course, a student should be able to:
1. Formula model of the controlled object and design the intelligent controller.
2. Based on the Matlab to program and simulate the mathematic model of object.
3. Communicate with the instructor and teammates, give presentation on the results of the project.

Course Content:
Lectures and Lecture Hours:

1. Introduction - Experimental equipment introduction - Task of course design	1
2. Formula the model of controlled object	2
3. Present the proposal of design	2
4. Simulating the control algorithm and implement the controller	6
5. Analyze the control performance and experiment results	3
6. Make a presentation for the course design	1

Grading:

Previewing report	10%
Proposal	20%
Experiment results and presentation	30%
Course design report	40%

Reference Book:
1.Beam&Ball control system experiment instruction
2.Inverted Pendulum control system experiment instruction
3.Dong Ning. Self-Adaptive Control. Beijing: Beijing Institute of Technology Press, 2009
4.Sun Zengxin. Intelligent Control Theory and Technology. Beijing: Tsinghua University Press, 2011

100064227 Specialized Internship

Laboratory hours: **16**
Course Credits: **2**

Course Description:
Professional practice is an important practical teaching link for students to apply their expertise to production practice. Through professional practice, it makes students to understand the theoretical knowledge and to obtain practical knowledge and accept the basic engineering and technical training from the production related to the field of electrical engineering, research and engineering practice. To broaden expertise, develop practical hands-on skills and improve problem-solving and problem-analyzing skills by engaging in production and technology development. At the same time, through Graduation Internship Practice to understand the business management knowledge, the professional nature and responsibilities of engineers and professional fields of new technologies, new processes and new achievements. And to improve the overall quality of college students by Professional ethics education, technical safety education and patriotic education.

Course Outcomes:
After completing this course, the students should be able to:
1. Understand the theory from practice, obtain perceptual professional knowledge, and develop career plan.
2. Engage in product design, manufacture, assembly, test, operation, maintenance and other practical activities of electrical engineering related areas.
3. Understand the basic methods of research, solve practical problems, develop engineering awareness, engineering ideas and engineering literacy.
4. Perceive the society, the industry, the corporate and the corporate culture; cultivate cooperating and hard-working spirit; have the sense of mission and responsibility for social progress and economic development.
5. Comply with the technical specifications, supervision rules, regulations and laws on safety production.
6. Preliminary understand the development status, new technologies, new products and prospects in the professional field.
7. Understand the impact of engineering practice on social, environmental protection and sustainable development.
8. Understand the basic situation of enterprise operation and management.

Course Contents:
1. Introduce the development of automation and electrical engineering technology;
2. Introduce the important role and current status of automation and electrical engineering technology in the development of national economy;
3. Introduce the electrical control devices, automatic control devices and their working principles, which are commonly used in production, and to introduce their practical application and function;
4. Cultivate the ability to work independently; cultivate the ability of observation and analysis; accumulate social experience for future career;
5. Deepen the understanding of the interrelationship and function of various courses in the undergraduate stage, and arouse the enthusiasm to contribute to the modernization construction.

Grading:

Homework and In-class Quizzes	20%
Experimental results	20%
Final	60%

100064228 Control System Design

Lecture Hours: 32
Laboratory Hours: 20
Credits: 2
Prerequisites: Control Theory, Microcomputer Principle and Interface Technology, C++

Course Description:
This course is a specialized basic course for automation, electrical engineering & automation，to train students the ability of system simulation and skills of system analysis, design and application. The mission is to enable students to master the system modeling, the basic principle and application of MATLAB/Simulink toolbox. The simulation experiments of time domain analysis and frequency domain analysis could cultivate students' system modeling and simulation analysis ability. The main content is to design practical control system algorithm with step response and sine tracking, to raise the basic ability of system analysis, design.

Course Content:
Chapter1 Basic Knowledge of System Modeling 2
1.1 The mathematical model of the vehicle movement system
1.2 The mathematical model of the two- level tank system
1.3 The basic structure of control system
Chapter2 Application of Simulink in System Simulation 4
2.1 Basic knowledge of Simulink
2.1.2 Commonly Used Blocks of Simulink
2.1.1 Toolbox Module of Simulink
2.2 Application of Simulink in System Simulation
2.2.1 Response analysis of typical input signal in time domain
2.2.2 Response analysis in frequency domain
2.3 Modeling and simulation of DC-motor dual closed-loop control system
2.4 Nonlinear system analysis and simulation experiment
Chapter3 Experiment of Controller Design Simulation 4
3.1 Design experiment of PID controller
3.1.1 Overview of PID controller
3.1.2 Proportional (P) controller
3.1.3 Integral (I) controller
3.1.4 PI controller
3.1.5 PD controller
3.1.6 PID controller
3.2 PID controller parameter setting experiment
3.2.1 Ziegler-Nichols method
3.2.2 Critical oscillation method
3.2.3 Controller tuning based on attenuating curve
3.2.4 Experience piece-try method
3.3 Fuzzy control system experiment
Chapter4 Electro-Hydraulic Servo Control System 2
4.1 Basic knowledge of electro-hydraulic servo control system
4.2 Mathematical model of electro-hydraulic servo control system
Chapter4 Proportional valve-controlled hydraulic cylinder system experiment 20
5.1 Step response experiment
5.1.1Design of controller software
5.1.2 Analysis of result & system performance
5.2 Sinusoidal tracking experiment
5.2.1Design of controller software

5.2.1Design of controller software

Grading:

Design& Discussion	10%
MATLAB Simulation	20%
Project Acceptance	20%
Project Presentation	20%
Project Report	30%

Text & Reference Book:

［1］张袅娜. 控制系统仿真[M]..北京：机械工业出版社，2014.
［2］薛定宇. 控制系统仿真与计算机辅助设计[M].北京：机械工业出版社，2009.

100064230 Graduation Project (Thesis)

Class Hours: **256**
Credits: **16**

Course Description:
Graduation Project (Thesis) is a comprehensive, creative part of teaching practice for undergraduate students. It is a comprehensive summary of the basic theories, professional knowledge and practical skills the students have learned. It is the overall test of the academic performance and practice skills of the students.

Course Outcomes:
1. To cultivate undergraduate student's ability of analyzing and solving problems by using knowledge and skills.
2. To cultivate undergraduate student's ability of practice and writing.
3. To cultivate undergraduate student's ability of investigation, collection and processing information as well as the ability of acquiring new knowledge.
4. To cultivate undergraduate student's sense of innovation, attitude of serious scholarly research and rigorous style of work.

Course Content:
The subject types of graduation design (Thesis) of automation specialty can be divided into three types: engineering design, technical science research, engineering technology research and theoretical research. Any topic of subject should be related to the professional field of the major, the main contents include: the theory and application of control, motion control, process control, pattern recognition and intelligent system, detection technology and automatic equipment, navigation and guidance, system engineering, computer technology, electrotechnics, electrical engineering etc.

- **Topics of engineering design**

The purpose of engineering design is to transform the technological principle into technical reality, or to create the foundation for transforming scientific research achievements into productive forces. This kind of graduation design is mainly based on the comprehensive training of engineers, mainly to train students' engineering practice ability. The students should make part of the engineering product or a relatively complete engineering design project during the graduation design. The engineering design emphasizes the systematicness, that is, from the proposal, analysis and calculation, design, production, test to the test results analysis. Each stage of the key technology should be clear. Students should understand the origin of the project, engineering design ideas and learn related technical specifications and engineering testing and so on.

- **Research-based topics of technical science and Engineering Technology**

This type of project does not necessarily require engineering products, which is characterized by exploratory and research. In order to make breakthroughs and innovations in key technologies, it mainly includes application research and development research, mainly based on applied research. This paper focuses on how to transform the theory and knowledge of natural science into new products, new processes and new processes, so as to link natural science theories with social production. The result is generally a technical prototype, it can also develop practical products, including software and hardware development or both hardware and software development .Hardware requirements include technical specifications, design proposals, implementation and commissioning reports, etc. Software topics must include software flow charts, software development and debugging, source programs, and so on. This kind of subject is closely integrated with the research topic of the faculty adviser.

- **Topics of theoretical research**

This type of subject are mainly rational analysis of engineering practice or scientific activities and relatively complete and rigorous demonstration or the exploration and demonstration of a new technology in the field of automation. First of all, the subject should be academic. It is the expression of specialized and systematic research results on a problem. Secondly, it has originality, which requires the author to have a new discovery, a new theory and a new conception for a certain problem in the academic circle, or have the new development and improvement of the previous theories and views, in order to promote the in-depth research. Finally, research should be scientific. It requires the author's system to be complete, not piecemeal or partial, and to be realistic rather than subjective.

The principle of selecting the topic:

- The topic must meet the training objectives and basic teaching requirements of the major, so that students can use the knowledge and skills they have learned on the basis of the knowledge of their major, and cultivate the ability to work independently.
- Priority should be given to those topics with practical application value such as production, research, laboratory construction and social practice so as to enhance students' sense of responsibility, urgency and economic concepts and reduce virtual subject.
- The topic should be submitted to the teaching and research office (subject group) for the group discussion. After the adoption, and through the teaching and research section (subject group) director signature, the college (Department) dean of teaching (Teaching director) examination and approval the subject can be implemented.
- The students are allowed to choose or make their own subjects, and after teaching and Research Section (subject group) director's approval, college (department) teaching Dean (Teaching Director)'s approval the subject can be implemented.
- To promote the subject combined professional internship and industry-university-research cooperation.

Grading:

Evaluation assessment is given according to the student's actual independent performance in the graduation project and the corresponding scoring standards.

1. The score of the graduation design shall be set as one of five levels, excellent, good, medium, pass and fail.
2. The comprehensive evaluation of the results using the "structure points", the composition of the structure points is composed of the assessment grades from the instructor, the reviewer and the defense team which account for 30%, 30% and 40% of the total score respectively.

101062102 Fundamentals of Electric Circuits A

Lecture Hours: **64**
Laboratory Hours: **16**
Credits: **5**
Prerequisite(s): General Physics (I, II)

Course Description:
Ohm's Law, Kirchhoff's Laws, and network element voltage-current relations. Application of mesh and nodal analysis to circuits. Dependent sources, operational amplifier circuits, superposition, Thevenin's and Norton's Theorems, maximum power transfer theorem. Transient circuit analysis for RC, RL, and RLC circuits. Sinusoids and phasors, sinusoidal steady-state analysis, AC power analysis, three-phase circuits, magnetically coupled circuits. Laboratory experiments include analog and digital circuits; familiarization with test and measurement equipment; familiarization with Ohm's Law and Kirchhoff's Laws, familiarization with Computer Simulation of a D.C. Circuit, familiarization with Current and Voltage Divider Rules, familiarization with Superposition and Thevenin/Norton Theorems, familiarization with Frequency Domain Analysis, familiarization with Maximum Power Transfer and Average and RMS Values.

Course Outcomes:
After successfully completing the course, a student will be able to:
1. Understand the basic concepts of DC and AC circuit behavior
2. Develop and solve mathematical representations for simple circuits;
3. Understand the use of circuit analysis theorems and methods;
4. Design an electric circuit.

Course Content:
Lectures and Lecture Hours:

1 Basic Concepts	2
1.1 Introduction	
1.2 Systems of Units	
1.3 Charge and Current	
1.4 Voltage	
1.5 Power and Energy	
1.6 Circuit Elements	
2 Basic Laws	4
2.1 Introduction	
2.2 Ohm’s Law	
2.3 Nodes, Branches, and Loops	
2.4 Kirchhoff’s Laws	
2.5 Series Resistors and Voltage Division	
2.6 Parallel Resistors and Current Division	
2.7 Wye-Delta Transformations	
3 Methods of Analysis	6
3.1 Introduction	
3.2 Nodal Analysis	
3.3 Nodal Analysis with Voltage Sources	
3.4 Mesh Analysis	
3.5 Mesh Analysis with Current Sources	
3.6 Nodal and Mesh Analyses by Inspection	
3.7 Nodal Versus Mesh Analysis	
4 Circuit Theorems	6

10.6 Thevenin and Norton Equivalent Circuits
10.7 Op amp AC Circuits
10.8 AC Analysis Using PSpice

11 AC Power Analysis	6

11.1 Introduction
11.2 Instantaneous and Average Power
11.3 Maximum Average Power Transfer
11.4 Effective or RMS Value
11.5 Apparent Power and Power Factor
11.6 Complex Power
11.7 Conservation of AC Power
11.8 Power Factor Correction

12 Three-Phase Circuits	4

12.1 Introduction
12.2 Balanced Three-Phase Voltages
12.3 Balanced Wye-Wye Connection
12.4 Balanced Wye-Delta Connection
12.5 Balanced Delta-Delta Connection
12.6 Balanced Delta-Wye Connection
12.7 Power in a Balanced System
12.8 Unbalanced Three-Phase Systems

13 Magnetically Coupled Circuits	4

13.1 Introduction
13.2 Mutual Inductance
13.3 Energy in a Coupled Circuit
13.4 Linear Transformers
13.5 Ideal Transformers
13.6 Ideal Autotransformers
13.7 Three-Phase Transformers

Laboratories and Laboratory Hours:	**16**

(1) Resistor's and Ohm's Law
(2) Kirchhoff's Laws
(3) Computer Simulation of a D.C. Circuit
(4) Current and Voltage Divider Rules
(5) Superposition and Thevenin/Norton Theorems
(6) Frequency Domain Analysis
(7) Maximum Power Transfer
(8) Average and RMS Values

Grading:

Homework	10%
Class Attendance	10%
Experiment	30%
Final Exams	50%

Text & Reference Books:

1) Charles K . Alexander and Matthew N.O. Sadiku, *Fundamentals of Electric Circuit*, Mc Graw Hill
2) James W. Nilsson and Susan A. Riedel, *Electric Circuits,* 8th edition, Publishing House of Electronics Industry.

101062103 Data Structures and Algorithms Design

Lecture Hours: 24
Laboratory Hours: 8
Credits: 2
Prerequisite(s): C or C++ programming

Course Description:
As an integrated basic course in computer science, this course mainly aims to make students know the goals and significances about data structures. Problem solving via computer involves data processing. Data expression and data processing are the very content of data structures and algorithms design. The primary aims of this course are to teach students how to choose suitable data structure, store structure and its corresponding algorithm for a specific problem solving. Students are expected to learn how to analyze the time cost for an algorithm, and the course learning is also a training process of how to design a complex program. Students are required to be able to write correct and effective algorithm with clear structure for a specific problem solving. Experiments make students go through strict and fundamental training so as to lay a good foundation for their succeeding program design.
This course uses C language as describing tool, researches the data logical structure, store structure and its corresponding algorithm through data abstraction. The basic concept, basic algorithm and algorithm design & implementation are emphasized during the whole teaching process. It helps students with non-computer majors to set up the basic concept about data structure and algorithm design, and it is also an important foundation for succeeding programming course.

Course Outcomes:
After completing this course, a student should be able to:
1. know data structures and their classifications, the relationship between data structures and algorithms;
2. understand the basic data structures and their operations;
3. know how to select the specific data structures according to the actual problems;
4. understand the main steps for algorithms design and analysis.

Course Content:
Lectures and Lecture Hours:
1. Introduction and algorithm analysis 2
Students are expected to:

know the course objective, contents, character and mission
know the basic concepts and terminology about data structures
know the basic concepts of data type and abstract data type
understand the properties and design objectives of algorithms
comprehend the time complexity of algorithms and its basic analysis techniques Difficulties:
the concept of the time complexity of algorithms
the time complexity analysis method of algorithms

Lists 4
Students are expected to:

know the logical structure of lists
know two implementation methods of lists: array-based list (sequence list) and linked list
know several variations of linked lists, e.g. (single) linked lists, circular linked lists, doubly linked list, as well as their differences

comprehend the basic operation algorithms for sequence list and linked list - understand the application example of linked lists: the presentation and addition of single-variable polynomials

Key points:

the storage structural differences between sequence lists and linked lists

the basic operation algorithms of sequence lists and linked lists, e.g. Find, Insert and Delete

Difficulties:

the operation and implementation algorithms (e.g. Find, Insert and Delete) of single linked lists

2. Stack and queue 4

Students are expected to:

know the concepts, characteristics and ADT of stacks & queues

comprehend the basic operation algorithms of sequence stacks (implemented by array) - understand the application example of stack: algorithm for evaluating expressions - comprehend the basic operation algorithms of circular queues (implemented by circular array)

understand the complex application example of stack & queue: test if a character string is a palindrome

Key points:

The basic operation algorithms for sequence stacks, e.g. Push and Pop

The basic operation algorithms for circular queues, e.g. EnQueue and DeQueue

Difficulties:

The judgment conditions of a full and an empty queue

3. Trees and binary trees 6

Students are expected to:

know the definitions, terminologies of trees and binary trees

know two types of special binary trees: full binary tree and complete binary tree - comprehend two binary tree representations: array representation and double linked list representation

know binary tree traversal methods, e.g. DLR, LDR, LRD, understand their traversal algorithms

know binary search tree structure; understand its basic operation algorithms, e.g. Traversal, Search, Insert and Delete

Key points:

Characteristics and storage structures of binary trees

Binary tree traversal methods and its applications Difficulties:

Binary tree traversal algorithms and its implementation

4. Graph 4

Students are expected to:

know the definition and terminology of graph

know two graph representation methods, especial adjacency matrix and adjacency list - know two graph search methods, e.g. depth-first search and breadth-first search, understand its corresponding algorithms for connected or unconnected graph

know minimum spinning tree, comprehend its two construction methods, Prim’s and Kruskal’s algorithm

Key points:

Adjacency matrix representation and adjacency list representation of a graph

Depth-first search and breadth-first search algorithm

Prim's and Kruskal's algorithm for constructing a minimum spinning tree Difficulties:

Connected component of a graph

5. Sorting 2

Students are expected to:

know the basic concepts about sorting and the judgment criteria of a sort algorithm

know the basic idea of Insertion sort (e.g. straight insertion sort and binary insertion sort), Shell sort, Heap sort and Quick sort, understand Insertion sort and Quick sort algorithm

Key points:

The algorithm thought of Insertion sort, Shell sort, Heap sort and Quick sort, as well as their differences

6. Hashing 2

Students are expected to:

know Hashing table, collision and Hashing function

know Collision resolution method, e.g. separate chaining, Open addressing (Linear probing, Quadratic probing and double hashing)

Key points:

Concept of Hashing table and Hashing function, as well as simple collision resolution methods

Laboratories and Laboratory Hours:

1. Algorithm implementation of linked lists 2

Solve Josephus problem (or Josephus permutation) by singly circular linked list.

Test case:

Input N = 10, m = 3 and k = 4, then the output series should be 6, 10, 4, 9, 5, 2, 1, 3, 8 and 7.

2. The basic operation algorithms of stacks 2

Use evaluating expression algorithm based on stack operations to implement a simple calculator including operators like ＋, －, ×, ÷, ＝, (and).

Test case:

if input expression 4+2*5, then output 14;

if input expression (4+2)*(2-10), then output -48.

3. The basic operation and application of binary trees 2

Use LDR, DLR and LRD traversal algorithms to construct and traverse a binary tree. Input an extend preorder traversal sequence of a binary tree, then create this tree structure and output its Preorder, In-order and Post-order sequence, respectively.

Test case:

A binary tree whose preorder and in-order sequences are ABDEGCF, DBGEACF respectively.

4. Sorting algorithm implementation 2

Input 10 numbers from the keyboard, and write a program to sort the 10 numbers by straight insertion sort, binary insertion sort, and quick sort algorithm.

Test case:

Input 10 number series 12, 9, 3, 5, 8, 1, 4, 15, 2, 6, the output number series should be 1, 2, 3, 4, 5, 6, 8, 9, 12, 15.

<u>Grading:</u>

Homework and Instructor Evaluation	10%
Experiment work	20%

Electrical Engineering

Final exam	70%

Text & Reference Books:

- Required reading:

Mark Allen Weiss. *Data Structure and Algorithm Analysis in C,* 2nd edition, 2010, China Machinery Press

- Recommended reading:

Yan Wei Min, *Data Structure in C*, 2004, Tsinghua University Press

- Recommended Software and Development Environment:

VC++6.0

101062104 Analog Electronics A

Lecture Hours: **54**
Laboratory Hours: **0**
Credits: **3.5**
Prerequisite(s): General Physics (I, II), Fundamentals of Electric Circuit Analysis

Course Description:
This course covers diode, bipolar junction transistor, characteristics of field-effect transistor. Common-emitter amplifier, common-collector amplifier, common-base amplifier, analysis of Q-point, ac parameters analysis (voltage gain, input resistance and output resistance). Analysis of multistage amplifier circuits and differential amplifier circuits. Frequency response of Amplifier circuits. Effects of various negative feedback on amplifiers, estimation of closed loop gain. Virtual short and virtual open in the linear circuits of operational amplifiers. Analysis of various wave generating circuits. Construction and analysis of power suppliers.

Course Outcomes:
After completing this course, a student should be able to master the fundamental theory, concepts, analysis methods and techniques of the analog electronics. Details are listed in the following:
1. Fundamental concepts, characteristics and parameters of semiconductor devices.
2. Theory and analysis of fundamental amplifier circuits.
3. Characteristics and analysis of feedback circuits.
4. Analysis and applications of linear and nonlinear operational amplifier circuits.
5. Analysis and design of wave generation circuits and power suppliers.
6. Simulation methods of amplifier circuits using Multisim2001.

Course Content:
Lectures and Lecture Hours:

1. Semiconductor Materials and Diodes 2
   Semiconductor Materials
   Semiconductor Diodes
2. Bipolar Junction Transistor (BJT) and Basic BJT Amplifiers 8
   Bipolar Junction Transistor
   Fundamental Theory and Performance Evaluation of BJT Amplifiers
   Graphical Methods for BJT Amplifier Analysis
   Small-signal Equivalent Circuits for BJT Amplifier Analysis
   Other Basic BJT Amplifiers
   Compound Amplifiers

Field-Effect Transistor (FET) and Basic FET Amplifiers 4 - Field-Effect Transistor
   Basic FET Amplifiers

3. Multistage Amplifiers and Operational Amplifiers 6
   Connection and Analysis of Multistage Amplifiers
   Differential Amplifier Circuits
   Operational Amplifier Circuits
4. Power Amplifiers 4
   Introduction – Definitions and Amplifier Types
   Class-A Power Amplifiers
   Push-Pull Complementary Power Amplifiers
   Power Amplifier Circuits

Power Transistor Heat Sinking

5. Amplifier Frequency Response	3
Introduction	
Frequency Response of RC Circuits	
High-Frequency Equivalent Models of BJT and FET	
Frequency Response of Single Transistor Amplifiers	
Frequency Response of Multistage Amplifiers	
Time-domain Response	
6. Feedback in Amplifier Circuits	6
Concepts and Types of Feedback	
Block Diagram of Feedback Amplifiers	
Effects of Negative Feedback on Amplifiers	
Analysis of Negative Feedback Amplifiers	
Right Connection of Feedback in Amplifier Circuits	
Oscillation in Negative Feedback Amplifiers and Its Removal Methods	
7. Linear Applications of Operational Amplifiers	6
Introduction	
Basic Arithmetic Circuits	
Logarithm and Exponent Circuits	
Multiplication and Division Circuits	
Effects of Real Operational Amplifiers on Arithmetic Circuits	
Active Filter Circuits	
Switched Capacitor Filter Circuits	
8. Oscillators and Nonlinear Applications of Operational Amplifiers	8
Sine Wave Oscillator Circuit	
Voltage Comparator	
Non Sine Wave Generating Circuit	
9. DC Power Supply	5
Rectification Circuits	
Filter Circuits	
Regulator Circuits	
Integrated Regulator and Its Applications	
10. EDA Technology and Programmable Analog Devices	2

Grading:

Homework 10% Inclass Quizzes 10% Project 10% Final 70%

Text & Reference Book:

Donald A. Neamen, *Microelectronics-Circuits Analysis and Design*, 3rd edition, 2007, McGraw Hill Press and Tsinghua University Press.

101062106 Signal Analysis and Processing

Lecture Hours: 48

Credits: 3

Prerequisite(s): Fundamentals of Electric Circuit Analysis， Calculus and Differential Equations (I, II)

Course Description:

Signal analysis and processing is an introduction to analog and digital signal processing, a topic that forms an integral part of engineering systems in many diverse areas, including seismic data processing, communications, speech processing, image processing, defense electronics, and automatic control. The course presents and integrates the basic concepts for both continuous-time and discrete-time signals and systems. Signal and system representations are developed for both time and frequency domains, mainly for the LTI systems. These representations are related through the Fourier/Laplace/Z transforms. Matlab will be extensively used in the class, homework, and project. This course can train students' ability of signal analysis, system analysis, and corresponding analysis and calculation ability.

Course Outcomes:

After completing this course, a student should be able to:

1. Familiarize with the basic signals and basic classification of systems
2. Represent signals by unit samples or unit impulse
3. Master convolution and convolution properties
4. Analyze and characterize LTI systems using the Fourier/Laplace/Z transform
5. Draw the pole-zero plot of Laplace/Z transform
6. Represent LTI system by block diagram and Signal flow graph
7. Familiarize with Frequency-Selective Filters and sampling theorem
8. Use Matlab to process basic signals
9. Use the theory and methods of signals and systems to deal with the practical problems
10. Lay a solid foundation for the study of the following courses

Course Content:

Lectures and Lecture Hours:

1. Introduction 4
    - What is a Signal?
    - Definition and mathematical representation of signals
    - Classification of signals
    - Basic operations on signals
    - Elementary signals
    - What is a System?
    - Classification of systems
    - Basic interconnections of subsystems
2. Linear Time-Invariant systems 10
    - Representation of discrete-time signals by unit samples
    - Convolution sum
    - Representation of continuous-time signals by unit impulses
    - Convolution integral
    - Properties of linear time-invariant systems
    - Block Diagram Representations of First-Order Systems
3. Fourier series representation of periodic signals 4
    - The response of LTI systems to complex exponentials
    - Fourier series representation of continuous-time periodic signals

- Properties of continuous-time Fourier series
- Fourier series representation of discrete-time periodic signals
- Properties of discrete-time Fourier series
- Fourier series and LTI systems

4. The continuous-time Fourier Transform 10
    - Representation of Aperiodic signals: The continuous-time Fourier transform
    - The Fourier transform for periodic signals
    - Properties of the continuous-time Fourier transform
    - Systems characterized by linear constant-coefficient differential equations
    - Frequency-Selective Filters
    - Transmission without Distortion
    - Sampling Theorem
5. The discrete-time Fourier Transform 8
    - Representation of Aperiodic signals: The discrete-time Fourier transform
    - The Fourier transform for periodic signals
    - Properties of the discrete-time Fourier transform
    - Systems characterized by linear constant-coefficient difference equations
    - Discrete-time Frequency-Selective Filters
    - Transmission without Distortion
    - Sampling of discrete-time signals
6. Laplace Transform (ch9 of textbook) 6
    - Definition
    - The region of convergence for Laplace transform
    - The pole-zero plot
    - Properties of the Laplace transform
    - Analysis and characterization of LTI systems using the Laplace transform
    - System function algebra and block diagram representations
    - Signal flow graph representation
7. Z Transform (ch10 of textbook) 6
    - Definition
    - The region of convergence for Z transform
    - The inverse Z transform
    - The pole-zero plot
    - Properties of the Z transform
    - Analysis and characterization of LTI systems using the Z transform
    - System function algebra and block diagram representations
    - Analysis and characterization of LTI systems using the Laplace transform
    - System function algebra and block diagram representations
    - Signal flow graph representation

Grading:

Homework	10%
Inclass Quizzes	10%
Project	10%
Final	70%

Text & Reference Book:

1) Alan V. Oppenheim, Alan S. Willsky, Syed Hamid Nawab. Signals and systems, 2nd edition, Prentice Hall, 1997.
2) Simon Haykin, Barry Van Veen. Signals and systems, 2nd edition, Johnwiley & Sons, Oxford Press, 2002.
3) B P Lathi, Linear Systems and Signals, 2nd edition, Oxford Press, 2005.

101062205 C++ Programming

Lecture Hours: **32**
Laboratory Hours: **18**
Credits: **2**
Prerequisite(s): Computing Science and Programming

Course Description:
This is a fast-paced introductory course to the C++ programming language. The course is intended for those with little programming background, though prior programming experience will make it easier. The course is also for those who have previous experience and still need to learn C++-specific constructs and concepts. OOP (Object Oriented Programming) will be the core of the course. After completing this course, a student should be able to: understand and use the fundamental programming concepts of C++; manipulate basic standard C++ facilities, such as strings, vectors and pointers; apply object-oriented approaches to software problems in C++; Write small-scale C++ programs using the above skills; isolate and fix common errors in C++ programs.

Course Outcomes:
After completing this course, a student should be able to:
1. Understand and use the Fundamental programming concepts of C++
2. Manipulate Basic Standard C++ facilities, such as strings, vectors and pointers
3. Apply object-oriented approaches to software problems in C++
4. Write small-scale C++ programs using the above skills
5. Isolate and fix common errors in C++ programs

Course Content:
Lectures and Lecture Hours:

1. Introduction 2
    Course overview
    C++ origin;
    First program: Hello world.
2. Objects, types, and values 2
    Strings and string I/O;
    Integers and integer I/O;
    Types and objects;
    Type safety.
3. Errors 2
    Vectors;
    Kinds of errors;
    Argument checking;
    Error process and Exceptions;
    Debugging and Testing.
4. Language Technicalities 2
    Declarations and Definitions;
    Headers and the preprocessor;
    Scope;
    Namespaces and Using statements.
5. Classes 2

Implementation and interface;
Constructors;
Member functions;
Enumerations;
Operator overloading.

6. Fundamental I/O concepts 2
I/O errors;
Files;
Opening, Reading and writing streams;
Reading a single integer.

7. Customizing I/O 2
Integer;
Numeric output;
Floating point;
File modes;
Binary I/O

8. Display model 2
Positioning;
String streams;
Line-oriented input;
Character input;
Character classification.
Why graphics?
A graphics model;

9. Graphics classes 2
Graphing: Model, Code organization;
Interface classes: Point, Line, Lines, Grid, etc.;
Functions and graphing.

10. Review and discussion of the covered topics, Q&A. 2

Laboratories and Laboratory Hours:

1. Appendix C: Getting started with Visual Studio; 2 Appendix D: Installing FLTK; Chapter 3 Drill 1~5.
2. Chapter 4 Drill 7~8. 2
3. Chapter 5 Drill; Ex. 8. 2
4. Chapter 8 Ex. 5~7. 2
5. Chapter 9 Drill; Ex. 5. 2
6. Chapter 10 Ex. 2~4. 2
7. Chapter 12 Drill; Ex.7~8. 2
8. Chapter 13 Drill; Ex. 1. 2
9. Chapter 14 Drill; Ex.1. 2

Grading:

Homework	10%
Project	10%
Final	70%
Instructor Evaluation	10%

Text & Reference Books:

1)Bjarne Stroustrup, *Programming: Principles and Practice using C++*, Pearson Education/China

Machine Press, 2009.
2) *Introduction to C++,* MIT OCW for IAP, 2011.
3) Introduction to C management and C++ Object-Oriented Programming, MIT OCW for IAP, 2010.
4) *C++ Track*, California Institute of Technology, 2011.
5) Simon Allardice, Foundations of Programming: Object-Oriented Design, Lynda.com, 2012
6) E Balagurusamy, *Object Oriented Programming with C++,* 4th edition, Mc-Graw Hill, 2009.
7) Bruce Eckecl, *Thinking in C++,* 2nd edition, Prentice Hall, 2002.

101062219 Electric Circuit Lab A

Lecture Hours: 0
Laboratory Hours: 16
Credits: 1
Term: The second term of freshman year
Prerequisite(s): Mathematical Analysis for Engineering, Physics

Course Description:
This course is one of the most important experiment courses of Electrical Specialty in colleges and universities. Students are required to grasp the necessary basic knowledge of circuit analysis before learning this course. The primary content of the "circuit experiments" has a broad background of engineering, which includes analysis of the circuit, exploring and verifying the basic laws as well as analysis methods of electric circuit, playing a significant role in establishing a rigorous scientific attitude and engineering viewpoint of applying theory to reality. The course simultaneously develops scientific thinking skills and capacity of experimental research and scientific induction. Furthermore, through the curriculum, we will reach to the purpose that students could deepen the understanding of essential theoretical knowledge as well as measurement and analysis methods of circuit.

Course Outcomes:
After completing this course, a student should be able to:
1. Master the basic experimental operation skill and the usage of common instruments.
2. Grasp the basic method of simple circuits designing and ability of analyzing and eliminating simple circuits faults independently.
3. Deeply understand the circuit theory through analyzing the circuit experiment phenomenon.
4. Improve the ability to analyze and solve problems and building the realistic, rigorous scientific attitude and good experimental habits.
5. Master the simulation of software (Multisim) in the circuit experiment and the operation of the software.

Course Content:
Laboratories and Laboratory Hours:
(Hardware)
1. The instructions of the instruments and measurement of the volt-ampere characteristics of fundamental components. 2
2. Study on the response of First-Order dynamic RC circuit. 2
3. Study on the response of First-Order dynamic series RLC circuit. 2
4. Study on the switching characteristic and controlled current sources characteristic of the transistor. 2
5. Study on the responses of Operational Amplifiers. 2

(Software)
1. Verification of Thevenin theorem. 1
2. Verification of superposition principle. 1
3. Responses of First-Order dynamic RC circuit. 1
4. Responses of Second-Order dynamic RLC Circuits. 1
5. Switching characteristic and controlled current sources characteristic of the transistor. 1
6. Responses of Operational Amplifiers. 1

Grading:

Preview	20%
Operation	50%
Report	30%

Text & Reference Book:
Charles K.Alexander, Fundamentals of Electric Circuit, 3rd ed., 2008, ISBN 9787302180104.
Li Hansun, Fundamentals of Circuit Analysis, 4th ed., 2006, ISBN 9787040184709.

101063107 Principle of Digital Logic and CPU

Lecture Hours: **64**
Laboratory Hours: **16**
Credits: **5**
Prerequisite(s): Fundamentals of Electric Circuit Analysis, Electric Circuit Lab
Students should be familiar with Kirchoff's laws, analysis of basic electrical and electronic circuits.

Course Description:
This course covers principles of binary numbers, digital systems, assembly language programming, and an overview of computer architecture. It provides a background in basic technology areas that are required to understand computer architecture and design.

Course Outcomes:
After successfully completing the course, the students will be able to
1. Analyze and design combinational logic circuits
2. Analyze and design sequential logic circuits
3. Develop and simulate gate-level models of digital logic circuits
4. Grasp language programming
5. Computer organization and design.

Lectures and Lecture Hours: (54)

1. Introduction, History of Computing 1
2. Binary, Hexadecimal, and Decimal Numbers 2
   - The Computer Number System
   - Binary Numeric Representation
   - Converting Binary-Hexadecimal
   - Integer Binary/Decimal Conversions
   - Converting Decimal Fractions - Binary Fractions
3. Signed Binary Numbers and Binary Codes 2
   - Binary Sign Representations
   - Finding Two's Complements
   - Converting Two's Complement Binary- Decimal
   - Two's Complement Binary Math
   - ASCII Code
4. Boolean Algebra and Combinational Digital Logic 4
   - Boolean Algebra in the Computer
   - Truth Tables
   - Creating Boolean Functions
   - SOP and POS Boolean Representations
   - Using a Truth Table to Find Boolean Expressions
   - Step-by-Step Logic Circuit Design
5. Logic Simplification Using Karnaugh Maps 3
   - Simplifying Logic Circuits
   - Karnaugh Maps
   - Three-Variable Karnaugh Map
   - Four Variable Karnaugh Map
   - Karnaugh Map Terminology
   - Logic Simplification
6. More Complex Combinational Logic Circuits 2
   - Exclusive OR/Exclusive NOR (XOR/XNOR)

- Store Instructions

14. Decision Support Instructions 2
- Jump Instructions
- Jump Register (or Jump Return)
- Branch Instructions
- The Concept of Program Control and Branching

15. Shiftand Rotate, Procedures, and the Stack 2
- Shift and Rotate Instructions
- Examining Word Segments
- Subroutines or Procedures
- The Stack

16. Constructing Loops in SPIM 2
- Loops
- A Loop Program: Reversing a String
- More Example

17. SPIM Programming Example 4
- Programming Problem
- Program Sequence
- Loop Mechanics
- Writing the Program
- Eliminating Leading Zeroes

18. Design of the ALU or Datapath.ppt 2
- The ALU or Datapath
- The MIPS Computer: An Example of Bit-Slicing
- ALU Components
- Program Counter Architecture
- More ALU Components – Data Memory
- The Sign Extender
- Data Bus Connection in a Load Instruction
- Data Bus Connection in a Store Instruction
- Branch Instructions
- Jump ALU Path
- Combining the Elements to Make a Complete ALU
- The Single Cycle ALU

19. Control Unit Design and Multicycle Implementation 2
- The Central Processor Unit (CPU)
- Functionality of Control Unit
- Current Architecture
- ALU Design with ALU Control Block Shown
- Op Code Control Block Signal Identifier
- Start of R-Type Instruction
- Load Instruction
- Branch Instruction
- Jump Instruction Circuitry Added
- Multicycle Implementation
- Intermediate Results Storage Requirements

20.The Pipeline MIPS Processor 2
- The Laundry Example
- The Pipeline Processor
- Pipeline Stages
- Single-Cycle Datapath
- Single-Cycle Datapath with Pipeline Registers
- Adding Control

- Hazards
- Data Hazard in the Pipeline
- Forwarding as a Solution to Data Hazards
- Result of Stall Approach
- Control Hazard Approaches

21. Memory Management in Modern Computers 2

- Memory Management in Modern Computers
- Relative Speeds of the CPU and DRAM
- Types of Memory
- DRAM
- Bulk Storage

Laboratories and Laboratory Hours:

1. Familiarization with Lab Equipment and Basic Logic Functions
2. Basic combinational logic
3. Build the RS and clocked D flip-flop circuits in the lab
4. Design an 8-bit adder
5. Design a more sophisticated assembly language loop program and in program debug and refinement.
6. Move a step up in sophistication by designing a program with a recursive loop

Grading:

Homework	10%
Class Attendance	10%
Experiment	30%
Final Exams	50%

Text & Reference Book:

V.P. Nelson, H.T. Nagle, J.D. Irwin, and B.D. Carroll, *Digital Logic Circuit Analysis & Design*, Prentice-Hall, 1995

101063108 Fundaments of Control Theory I

Lecture Hours: **64**

Credits: **4**

Prerequisite(s): Calculus and Differential Equations (I, II)

Course Description:

Modeling of dynamic systems: differential equations models, state space models, block diagram models, signal flow graph models, relationships between the various models. Solving the state equation: similarity transformation, minimal polynomial theory. Analysis of Control system characteristics: transient response, stability, steady state response. Analysis and design of control systems: root locus, frequency responses, and state space, including 180^{o} root locus, 0^{o} root locus, Nyquist Diagram, Bode Diagram, Nyquist Stability Criterion, controllability analysis, observability analysis, canonical forms of the state space representation, decomposition of the state space, observer-based state feedback design.

Course Outcomes:

After completing this course, a student should be able to:

1.Model dynamic systems using differential equations, state space, block diagram, signal flow graph models.

2.Analyze control system characteristics, such as transient response, stability and steady state response.

3.Analyze and design control systems using root locus and frequency responses.

4.Analyze and design control systems in state space using controllability, observability, observer-based state feedback design.

5.Use Matlab/Simulink to analyze and design systems.

Course Content:

Lectures and Lecture Hours:

1.Introduction 2

History of Automatic Control

Examples of Control Systems

Automatic Control Systems Classification

Closed-Loop Control Versus open-Loop Control

2. Mathematical Models of Dynamic Systems 8

Differential Equations of Physical Systems

Linear Approximations of Physical Systems

The Laplace Transform

The Transfer Function of Linear Systems

Block Diagram Models

Signal-Flow Graph Models

3. Solution of Differential Equations 8

Solution of Linear Time-Invariant Differential Equations

Solution of the State Equation

Evaluating the State Transition Matrix

4. Transient and Steady-State Response Analysis 6

Transient Response Analysis

Routh's Stability Criterion

Steady-State Response Analysis

5. Control Systems Analysis by the Root Locus Method 6

The Root Locus Concept

The Root Locus Construction
Some Special Cases

6. Control Systems Design by the Root Locus Method 2
Parameter Design by the Root Locus Method
Lead Compensation
Lag Compensation
Lead-Lag Compensation

7. Control Systems Analysis by the Frequency-Response Method 12
The Frequency-Response Concept
Bode Diagrams
Polar Plots
Log-Magnitude-versus-Phase Plots
Nyquist Stability Criterion
Stability Analysis
Relative Stability Analysis
Closed-Loop Frequency Response of Unity-Feedback

8. Control Systems Design by the Frequency-Response Method 2
Control System Design by Frequency-Response Approach
Lead Compensation
Lag Compensation
Lead-Lag Compensation
Ziegler-Nichols Rules for Tuning PID Controllers

9. Control Systems Analysis in State Space 10
State-Space Representations of Transfer-Function Systems
Controllability
Observability
Transform a State-Space Representation into Canonical Forms
Decomposition of the State-Space
Controllability and Observability in Frequency Domain

10. Control Systems Design in State Space 8
Pole Placement
Full-State Feedback Control Design
State Observers
Integrated Full-State Feedback and Observer

Grading:

Homework	30%
Inclass Quizzes	20%
Final	50%

Text & Reference Books:

1) Katsuhiko Ogata. *Modern Control Engineering,* 5th edition, [M]. Prentice-Hall International, Inc. 2009.
2) Richard C. Dorf, Robert H. Bishop. *Modern Control Systems,* 12th edition, [M]. Prentice-Hall International, Inc. 2010.
3) Jan Willem Polderman, Jan C. Willems. *Introduction to Mathematical Systems Theory: A Behavioral Approach*. Springer-Verlag New York, Inc. 1998

101063109 Power Electronics

Lecture Hours: **42**
Laboratory Hours: **6**
Credits: **3**
Prerequisite(s): Fundamentals of Electric Circuits Analysis, Analog Electronics

Course Description:
Power electronics is to introduce the theory, application and typical topologies in power conversion. The typical switches, the switching circuits, modeling, simulation and analysis will be introduced. This course will provide the students with the basic knowledge of power electronics and will give a conclusion of how to analyze power electronics circuits. This course can help the students obtain the necessary knowledge in machine control and converter design, and the knowledge in this course can meet the needs for renewable generation and power systems.

Course Outcomes:
After completing this course, a student should be able to:
1.Have an understanding of the concept of power electronics.
2.Know the necessary parts for a power electronics device.
3.Have an understanding of switching and modulation.
4.Analyze certain DC-DC converters.
5.Use PSPICE to simulate power electronics converters.
6.Have the ability to do model and design the switching patterns for certain circuits.

Course Content:
Lectures and Lecture Hours:

1. Intro to Power Electronics	2
Definitions of power electronics	
Type of power conversions	
Necessary parts in a system	
Future trends and application	
2. Switching Concepts and Overview of Power Semiconductor Devices	8
Semiconductor devices	
Ideal and practical switching process	
Snub circuits	
3. Phase controlled rectifier circuit	10
Introduction	
Theory of the phase controlled rectifier circuit	
Active inverter	
Harmonic and phase factor	
4. Non-isolated DC-DC Converters	6
Continuous Conduction Mode	
Discontinuous Conduction Mode	
5. Passive inverter	6
Introduction	
Basic concepts	
Sinusoidal Waveforms	
6. AC voltage regulation circuit and Cycloconverter	4

Basic concepts

Sinusoidal Waveforms

7. Soft switch 6

Introduction

Theory of the Soft switch

Grading:

Homework	20%
Inclass Quizzes	10%
Final	70%

Text & Reference Book:

Wang Zhaoan, Power Electronic Technology

101063110 Power System Analysis

Hours: **48**
Laboratory Hours: **0**
Credits: **3**
Prerequisite(s): Fundamentals of Electric Circuit Analysis, Analog Electronics, Power Electronics

Course Description:

Power system analysis is to introduce the basic concept of power system, the components in power system, equivalent circuit of different components, the power flow calculation, the fault calculation, the operation, the control and the stability of power system. This course is essential for students to get an idea of the power system and will provide them with the necessary knowledge needed in power grid operation and control.

Course Outcomes:

After this course, a student should be able to:
1.Have an understanding of traditional power systems, including the generation, the transmission and the consumption
2.Do three phase power system analysis
3.Have an understanding of three phase rotating machines
4.Do power flow calculations
5.Have a basic concept of fault calculation

Course Content:
Lectures and Lecture Hours:

1. Basic conception of power systems	2
Components in power systems	
Characteristics and operation principles of power system	
Parameters of power systems	
Chinese power systems	
2. Equivalent circuit of power systems	4
Introduction	
Equivalent circuits of transmission lines	
Equivalent circuits of transformers	
Equivalent circuits of power grid	
3. Power flow calculation	10
Voltage drop and power loss	
Power flow in power systems	
Power flow calculation algorithms	
Power flow calculation by computer	
4. Operation of power systems	8
Active power and frequency regulation	
Reactive power and regulation	
5. Fault calculation in power systems	8
Introduction on power systems fault	
Symmetric fault analysis	
Asymmetric fault analysis	

Grading:

Homework	10%
Inclass Quizzes	10%
Project	30%
Final	50%

Text & Reference Books:

1) J. Duncan Glover, *Power System Analysis and design*. Mulukutla S. Sarma, 2010.
2) Turan Gonen, *Modern Power System Analysis*. John Wiley & Sons, 1988.

101063111 Fundaments of Control Theory II

Lecture Hours: **48**
Credits: **3**
Prerequisite(s): Control Theory I

Course Description:
Analysis and design of linear discrete-time control systems; tools for analyzing nonlinear systems, such as the describing function and the phase plane methods; Lyapunov stability theory; optimal control systems theory including variation calculus, Euler-Lagrange equation, Pontryagin's minimum principle and Hamilton-Jacobi theory, linear quadratic optimal control systems, Bellman dynamic programming approach.

Course Outcomes:
After completing this course, a student should be able to:
1.Familiarize with the basic concepts and knowledge of linear time invariant discrete control systems, nonlinear control systems and optimal control systems.
2.Analyze and design linear discrete-time control systems.
3.Apply tools for analyzing nonlinear systems, such as the describing function and the phase plane methods, Lyapunov stability theory.
4.Grasp optimal control systems theory, including the variational calculus, Euler-Lagrange equation, Pontryagin's minimum principle and Hamilton-Jacobi theory, linear quadratic optimal control systems, Bellman dynamic programming approach.

Course Content:
Lectures and Lecture Hours:

1. Digital Control Systems 2
    Introduction
    Modeling Digital Control Systems in State Space
    Description of a Digital Control System
    The State Transition Matrix
    Solution of the State Equation
    Block Diagram
2. Description of Sampled Date System in Frequency Domain 2
    The Sampler and the Holder
    The z Transform
    The Inverse z Transform
    The Pulse Transfer Function
    The Pulse Transfer Function of a Discrete-Time System
3. System Characteristics 2
    Transient Response Analysis
    Stability Analysis
    Steady-State Response Analysis
    The Root Locus Approach
    The Frequency Response Approach
4. Analysis and Design of Discrete-Time Systems in State Space 2
    Stability Analysis
    Reachability, Controllability and Stabilizability

Popov Criteria
The Circle Criterion
Exercises and Problems

13. Optimal Control Systems	10
Introduction	
Parameter Optimization	
Variational Calculus and Optimal Control	
Pontryagin Maximum (Minimum) Principle and Hamilton-Jacobi-Bellman Theory	
14. Linear Quadratic Optimal Control Systems	4
Finite-Time Linear Quadratic Regulator I: Hamilton-Jacobi Approach	
Finite-Time Linear Quadratic Regulator II: Pontryagin's Minimum Principle	
Infinite-Time Linear Quadratic Regulator	
Linear Quadratic Gaussian Estimator	
15. Dynamic Programming	2
Introduction -A Network Problem	
Optimal Multistage Decision Process	
Numerical Method	
Optimal Control: a Dynamic Programming Approach	
16.Optimal Discrete-Time Control Systems	4
Variational Calculus for Discrete-Time Systems	
Discrete-Time Optimal Control Systems	
Time-Optimal Control Systems	
Optimal Quadratic Control Systems	
Energy-Optimal Control	

Grading:

Homework	20%
Instructor Evaluation	10%
Project	15%
Final	55%

Text & Reference Book:
Qinghe Wu, *Automatic Control Theory C*, Lecture Notes.

101063112 Electrical Machine and Drive

Lecture Hours: **70**
Laboratory Hours: **10**
Credits: **5**
Prerequisite(s): Power circuits, Power Machines, Control Theory

Course Description:
The course is to introduce the theory and control of different machines including DC machines and AC machines. Three types of DC machines and two kinds of AC machines are introduced. The design of current control loop and voltage control loop, vector control, direct torque control, speed sensor-less control and the design of power electronic converters are all analyzed in this course. This course can provide the students with the necessary knowledge in machine control and converter design.

Course Outcomes:
After completing this course, a student should be able to:
1. Understand the working theory of DC machines and AC machines.
2. Know the necessary parts in an electrical machine control system.
3. Understand control algorithm for DC machines.
4. Be able to design the control loop of a DC machine.
5. Understand vector control and direct torque control of AC machines.
6. Be able to design a machine control system on one's own.

Course Content:
Lectures and Lecture Hours:

1. Basic conception of electrical machines and drives	10
- Energy transform in electrical machines	
- Typical electrical machines	
- Typical control systems of electrical machines	
2. DC machine and control	18
- Principle of DC machine	
- Characteristics of DC machine	
- Open-loop control of DC machine	
- Close-loop control of DC machine	
3. AC machine and control I - induction machine	22
- Principle of AC machine	
- Traditional control of induction AC machine	
- Dynamic modeling and coordinate transformations	
- Vector control of induction AC machine	
- Direct torque control of induction AC machine	
4. AC machine and control II - PMSM	10
- Principle of PMSM	
- Vector control of PMSM	
- Speed control of BLDC	
5. Speed sensor-less control of machines	10
- Speed and flux estimation	
- Sensor-less control of inductive machine	
- Sensor-less control of PMSM	

Grading:

Homework	10

Inclass Quizzes	10
Project Design	20
Final exam	40
Laboratory time	20

Text Materials

Lecture Notes

Reference Book:

[1] Control of Machines. S.K. Bhattacharya, Brijender Singh, 2006.
[2] Control of Electrical Drives 3rd ed, Leonhard W, Springer Verlag, 2001.
[3] 电力拖动自动控制系统（第 3 版）, 北京: 机械工业出版社, 陈伯时, 2003.

101063113 Sensor and Measurement Technology

Lecture Hours: 32
Laboratory Hours: 4
Credits: 2.5
Prerequisite(s): Control Theory, Circuit Analysis

Course Description:
Concept of sensor, Static characteristics, Dynamic characteristics, Calibration. Resistive sensors, potentiometers, strain gages, signal conditioning for resistive sensors. Reactance variation and electromagnetic sensors, capacitive sensors, inductive sensors, electromagnetic sensors, piezoelectric sensors. Thermoelectric sensors, resistive temperature detector, thermal couple, thermistor. Optical sensors, photodiodes, phototransistor, photoresistors, photovoltaic sensors, position Encoders, fiber-optic sensors, image sensors. Digital and intelligent sensors, microcontroller interfacing, communication systems. Measurement of noise, errors during the measurement process and signal processing.

Course Outcomes:
On completion of this course, a student should be able to do the following.
1. Understand the role of sensors in automatic systems.
2. Select proper sensor for the performance requirement in the control loop.
3. Analyze the experimental data to improve its accuracy.
4. Analyze commonly used circuits for sensors.
5. Explain a basic measurement system.

Course Content:
Lectures and Lecture Hours:

1. Introduction 6
   - Concept of sensor
   - Static characteristics
   - Dynamic characteristics
   - Calibration
   - Effects of sensors on the control system performance
   - Impact of Sample and Hold with sensor in discrete control system
2. Resistive sensors 2
   - Potentiometer
   - Strain gage
   - Signal conditioning circuit and the application
3. Reactance variation and electromagnetic sensors 6
   - Capacitive sensor
   - Inductive sensor
   - Eddy current sensor
   - LVDT and RVDT
   - Electromagnetic sensor
   - Hall sensor
   - Signal conditioning circuit and the application
4. Piezoelectric sensors 2
   - The piezoelectric effect

- Piezoelectric materials
- Signal conditioning circuit and the application

5. Thermoelectric sensors	4
- Resistive temperature detector	
- Thermal couple	
- Thermistor	
- Signal conditioning circuit and the application	
6. Optical sensors	6
- Photoelectric effect and light sources	
- Photo multiplier	
- Photodiode and phototransistor	
- Photovoltaic cell	
- Fiber-optic sensor	
- Charge coupled sensor	
7. Measuring technology	3
- Measurement system	
- Data processing	
8. Digital and intelligent sensors	3
- Functions and architecture	
- Intelligent Sensor and control system	

Laboratories and Laboratory Hours:

1. Pressure Sensor Calibration	1
2. Temperature transducer design and experiment using RTD	3

Grading:

Homework	15%
Project/experiments	15%
Final	70%

Text & Reference Book:

1. Alan S. Morris, Measurement and Instrumentation Principles, 3rd ed., 2001, ISBN 0 7506 5081 8
2. Jacob Fraden, Handbook of modern sensors : physics, designs, and applications , 3rd ed.,2003, ISBN 0-387-00750-4
3. Ramon PallaÁs-Areny, John G. Webster, Sensors and signal conditioning , 2nd ed., 2000, ISBN 0-471-33232-1

101063114 Computer Controlled System

Lecture Hours: 40
Laboratory Hours: 0
Credits: 2.5
Prerequisite(s): Analog Electronics, Control Theory I, Digital Logic Circuit and CPU

Course Description:

This course is to guide students practically in combining the fundamental control theory with the microcontroller interface design. This course begins with the A/D and D/A conversion channel interface with microcontroller for control systems. Based on the channel design, PC and microcontroller bus interface, including ISA, PCI and STD-1553B, will be introduced; it also presents the design of discrete PID controller and many practical considerations for the system. Besides, two design methods in continuous domain and discrete domain are discussed respectively, such as root locus plot, frequency response method and state space method. Finally, the practical considerations of EMI for a digital control system are elaborated in detail including grounding, shielding and filtering.

Course Outcomes:

After completing this course, a student should be able to:
1. Develop an accurate A/D and D/A conversion channel for digital control systems.
2. Understand the development method of a PC bus interfacing microcontrollers and microcomputer such as PCI.
3. Design a discrete PID controller and understand the selection of critical parameters.
4. Learn the method of the digital controller design in continuous domain to meet the desired system specifications.
5. Learn the method of the digital controller design in discrete domain to meet desired system specifications.
6. Design an EMI system for specified control systems to meet the desired specification.

Course Content:

Lectures and Lecture Hours:

1. Introduction	2
The basic knowledge of control system	
The architecture of control system	
2. Microcontroller/Microcomputer Interface	12
Microcontroller/Microcomputer's External Interface	
D/A Conversion Output Channel	
A/D Conversion Input Channel	
Case Study	
3. Computer Buses	6
Basic Introduction of Computer Buses	
Example Buses: ISA and PCI	
Case Study	
4. Digital PID Controller	4
Functions of Digital PID Controllers	
The Selection of Critical Parameters of PID Controllers	
Selecting of Sampling Rate and Aliasing	
5. Design of Digital Controllers in Continuous Domain	4

Approximation Criteria of Continuous-Time Controllers
Approximation Method of Continuous-Time Transfer Functions
Comparison of the Performance for Different Approximation Method
Case Study

6. Design of Digital Controllers in Discrete Domain 6
Root Locus Plot
Frequency Response Method
State Space Method
Case Study

7. EMI Design for Control Systems 6
Grounding
Shielding
Filtering
Case Study

Grading:

Homework 10% Inclass Quizzes 5% Group Presentation 5% Project 15% Final 65%

Text & Reference Books:

1) G. Ellis, *Control System Design Guide*, 3rd edition, 2004, ISBN 0-12-237461-4
2) A. S. Tanenbaum, *Structured Computer Organization*, 5th edition, 2005, ISBN 0-13-148521-0
3) M. A. Mazidi, *8051 Microcontroller and Embedded Systems,* 2nd edition, 2005, ISBN 0-13-11940-2
4) K. J. Astrom, *Computer-Controlled Systems Theory and Design*, 3rd edition, 2002, ISBN 7-302-05008-2
5) R. C. Dorf, *Modern Control Systems,* 11th edition, 2008, ISBN 0-13-206710-2
6) J. Carr, *The Technician EMI Handbook*, 2006, ISBN 0-75-06723-31

101064115 Decision Support System

Lecture Hours: 32
Credits: 2

Course Description:
A Decision support system is a way to model data and make quality decision based upon it. In another words, decision support systems (DSS) are a class of computerized information system that support decision-making activities. The more information you get from external sources, the better your decision will be. Mostly, decision support systems are designed artifacts that have specific functionality. Five more specific Decision Support System types are included: i) communications-driven system, ii) data-driven system, iii) document-driven system, iv) knowledge-driven system, and v) model-driven system. This course critically examines issues confronting Decision Support Systems (DSS) in the business area. The characteristics and components of DSS are discussed in detail. It is pointed out that work activities that require decision making form a spectrum of problems ranging from structured problem to unstructured problem. DSS development and applications are briefly described.

Course Outcomes:
On completion of this subject, the student will be able to:
1) Understand main decision models, decision methods, and decision support systems
2) Apply decision support models, methods and systems in related business intelligence systems such as e-government, e-business, e-learning and warning systems
3) Appreciate current research issues in intelligent decision support systems, multi-criteria, multi-objective and multi-level decision support models, optimization theory, group decision-making models, computational intelligence (such as fuzzy logic), and their applications in business intelligence systems
4) Communicate in the form of technical reports and presentations
5) Work in a group to achieve a common objective and task

Course Content:
Lectures and Lecture Hours:

1. Decision models and methods	4
2. Decision support system and its development	4
3. Group decision support and business performance evaluation	6
4. Multi-criteria decision-making and its business applications	6
5. Intelligent and cognition-driven process for business intelligence	8
6. Personalised recommender systems for business intelligence	4

Grading:

Homework	10%
In class Quizzes	5%
Group Presentation	5%
Assessment item 1: Essay	40%
Length: Approximately 2500 words	
Task: An essay on a relevant topic to this subject by one group.	
Assessment item 2: Class presentation	40%
Length: About 15 minutes	
Task: Group Presentation of summary of Essay and answering questions.	

Text & Reference Book:
1. Jie Lu, Guangquan Zhang, Da Ruan, Fengjie Wu "Multi-objective Group Decision Making: Method, Software and Applications with Fuzzy Set Techniques"[M], Imperial College Press. 2007

2. Daniel J. Power, "Decision Support Systems: Concepts and Resources for Managers"[M], 2002
3. Frada Burstein, Clyde Holsapple "Handbook on Decision Support Systems 1: Basic Themes"[M], Springer press,2008

102064116 Industrial Communication and Control Network

Lecture Hours: 24
Laboratory Hours: 8
Credits: 2
Prerequisite(s): Electronic Technology, Principle of Computer

Course Description:

This course is a general introduction on data communication networks and its application in industrial control system, principle of operations, and performance analyses. It includes basic conceptions, hardware, software, components, design, connections of network, as well as the requirement and feature of control network. Some concepts such as the OSI model, topologies, real-time system and major protocols are also covered. Besides, students will work on some experiments on RS485 communication, CAN bus and Industrial Ethernet for better understanding on the control network. Lectures and experiments will help students master basic knowledge about control network and establish sound values, including pursuing the truth and practice, integrity and profession dedication.

Course Outcomes:

After completing this course, a student should be able to:

1. Understand Layered Architecture of networks and basic conceptions of communication and networks.
2. Analyze criteria of communication and network, such as performance, reliability and security.
3. Design protocol for multi-node communication.
4. Design CAN bus system for multi-node communication.
5. Integrated design for control networks.

Course Content:

Lectures and Lecture Hours:

1. Introduction 1
   - Industrial Control Networks
   - Some basic conception and terms
2. Network model 2
   - Layered Tasks
   - The OSI Model
   - Layers in the OSI Model
   - TCP/IP Protocol Suite
3. Physical Layer and Media 5
   - Data and Signal
   - Digital Transmission
   - Analog Transmission
   - Bandwidth Utilization: Multiplexing and Spreading
   - Transmission Media
   - Switching
4. Data Link Layer 5
   - Error Detection and Correction
   - Data Link Control
   - Multiple Access
5. Controller Area Network 6

Introduction

CAN Technology Basics

CAN controller SJA1000

CAN-Based Upper Layer Protocols

6. Special Topics 5

Real-Time Systems

Network-Based Control

Fieldbus

Industrial Ethernet

Laboratories and Laboratory Hours:

1. RS485 communication experiment	2 hours
2. CAN bus experiment	4 hours
3. Industrial Ethernet experiment	2 hours

Grading:

Homework	10%
Group Presentation	5%
Experiments	25%
Final	50%
Instructor Evaluation	10%

Text & Reference Book:

Behrouz A Forouzan. Introduction to Data Communications and Networking, Fourth Edition. McGraw-Hill Companies, Inc., 2007.

Supplementary Texts & References

Bogdan M. Wilamowski, J. David Irwin. Industrial Communication Systems. CRC Press, 2011.

CAN Specification. Version 2.0. Robert Bosch GmbH, 1991.

Data sheet of SJA1000 Stand-alone CAN controller. Philips Semiconductors, 2000.

102064217 Motor Control System Project

Laboratory Hours: 1.5 week
Credits: 1.5
Prerequisites: Electrical Machine and Drive, Power Electronics

Course Description:
This course is to design and debug a typical automatic control system which is current-speed double closed-loop DC speed control system. Establish a mathematical model of the system by measuring the parameters of each module of the speed control system. Design current and speed controllers by engineering design method. The current regulator is designed according to a typical type I system, and the speed regulator is designed according to a typical type II system. System meets the fast start, no static, anti-jamming and other performances.

Course Outcomes:
After completing this course, a student should be able to:
1. Design current-speed double closed-loop DC speed control system.
2. Establish a mathematical model of each module of the speed control system.
3. Design and debug current and speed controllers with engineering design method.
4. Test and analyze the performance of the system.
5. Have team awareness through team building and cooperation.
6. Do project management.

Course Content and Hours:
1. Introduce the experiment equipment of electric drive control system describing the basic theory of electric drive and the basic method of designing a typical electric drive control system briefly. 2
2. Team building and task division. Develop design and work progress. 2
3. Measure the parameters of the actuator such as armature circuit resistance, motor resistance, smoothing reactor resistance, power supply resistance, motor moment of inertia, electromechanical time constant, electromagnetic time constant, no load power and motor open loop mechanical characteristics. 6
4. Measure the parameters of each part of the system such as speed feedback coefficient, current feedback coefficient and so on. 4
5. Study the principle of gate trigger. Measure the relationship between synchronized voltage and thyristor firing angle. Analyze the relationship of 6 thyristor firing angle. Test thyristor magnification and the effect of load on thyristor rectification. 6
6. According to the tested parameters, establish a mathematical model of the system. Design the regulator of the speed regulating system based on the engineering design method according to the requirements of the given performance index, the current regulator is designed according to a typical type I system, the speed regulator is designed according to a typical type II system. 6
7. Debugging the DC speed control system until the inner ring, outer ring and the overall performance indicators are in line with the requirements, and then the system anti-jamming test.6
8. Summary and test. 4

Grading:

Summary report	40%
Field experiment	30%
Test	30%

Additional information: Reward 1-10 points for putting forward innovative or reasonable suggestions. Deduct 10 points for late submission. Deduct 10 points for typos.

<u>Text & Reference Book:</u>

Text book:

Design Guide for Electrical Drive Course Design.

Reference book:

[1] Liao xiaozhong, Liu xiangdong. Automatic control system [M]. Beijing: Beijing Institute of Technology Press, 2011.
[2] Xia xunshun. Drag the automatic control system experimental guidance [M]. Shanghai: Mechanical Industry Press, 1984.

103063118 Principles and Application of Digital Signal Processor

Lecture Hours: **32**
Laboratory Hours: **8**
Credits: **2**
Prerequisite(s): Analog Electronics A, Digital Electronics, Microcontroller Unit(MCU),C++ Programming Language]

Course Description:
The objective of this course is to familiarize students with the DSP core, system architecture and chip peripheral modules to solve system control problems. Students will be able to develop embedded control systems appropriate for different objectives.
The main topics of course are system architecture and peripheral interface, fix point DSP operation theory and numeric scaling, embedded system development and applications, design of DSP interface circuit, processor expert and software design.
Course Outcomes:
After completing this course, a student should be able to:
1. Have an understanding of the concept of DSP.
2. Know the necessary parts for peripheral on chip.
3. Have an understanding of coding and testing.
4. Analyze control system and design.
Course Content:
Lectures and Lecture Hours:

1. Introduce to DSP	3
- Definitions of DSP	
- Features of DSP	
- Future trends and application	
2. Core of 56F800	2
3. Peripheral	6
- Introduction	
- Analog-to-Digital Converter	
- Flash Memory	
- Inter-Integrated Circuit Interface	
- General Purpose Input/Output	
- Joint Test Action Group Port	
- Pulse Width Modulator	
- Serial Communications Interface	
- Serial Peripheral Interface	
- Quad Timer	
4. System and applications	5
5. Interface and application circuit design	3
6. Software design	3
7. Application design	2
8. Laboratory	8
9. Competition	2

Laboratories and Laboratory Hours: None

Grading:

Report	15%
Competition	15%
Final	70%

Text & Reference Book: **N/A**

International Economy and Trade

Educational Objectives

This major aims to cultivate well-grounded, practical, creative and all-round research talents who are well developed in morality, intelligence and physical condition to meet the requirements of national modernization. We aim at training practical and multi-disciplinary expertise for the talents with certain background of sciences and engineering knowledge, to adapt economic globalization and the rapid development of science and technology. Graduates are expected to be the inter-disciplinary talents with strong learning ability, practice and innovation ability and foreign language skills. Graduates are expected to be able to carry out international business and other relevant management tasks in government, organizations and enterprises.

Core Courses

Calculus, Computer Fundamentals, Linear Algebra, Microeconomics, Probability and Statistics, Management operational research, International Marketing, Applied Statistics, Business Law, Money and Banking, Business Ethics and Social Responsibility, Econometrics, Practice of International Trade, International Business Law, International Finance, Research Methods on Applied Economics, International Trade Documents, Advanced topics on Applied Economics

Program Outcomes

The graduates will be qualified for international business and economy related fields, dealing with international business letters and related business documents, carrying out international business negotiations, formulating and executing international trade contracts, carrying out international market research, providing decision-making information for enterprises engaged in foreign trade activities.

The graduates are expected to have strong theoretical and professional knowledge about foreign economy and trade, to have good computer skills and English language skills which can be used in foreign trade activities.

Duration and Degree

4 years, Bachelor of Economics

Curriculum

Semester 1			Credits
100245101	大学英语 I	College English I	2
100245103	跨文化英语交流 I	Cross-Cultural English Communication I	2
100172101	微积分 A I	Calculus A I	6
100210008	职业生涯与人生规划 I	Career Development and life planning I	0.5
100210015	国际贸易专业导论 I	Introduction to International Trade I	0.5
100980001	军事理论	Military Theory	1
100980002	军事训练	Military Training	1.5
100070003	计算机应用基础	Foundations of Computer Application	2
100270001	思想道德修养与法律基础	Ideological and Moral Cultivation and Basics of Law	3
100930001	大学生心理素质发展	Psychological Quality Development of College Students	0
100320001	体育 I	Physical Education I	0.5
100270007	形势与政策 I	Policy and Political Situation	0.5
Elective	文化素质类通识教育课专项	General Education	4
Elective	实践训练通识课专项	Lab Electives	2
Total Hours			**25.5**

Semester 2			Credits
100172102	微积分 A II	Calculus A II	6
100210006	微观经济学	Microeconomics	3
100320002	体育 II	Physical Education II	0.5
100070008	数据库技术及应用	Database Technology and Application	3
100210026	会计学基础	Fundamentals of Accounting	2
100270002	中国近现代史纲要	The History of Modern China	2
100245104	跨文化英语交流 II	Cross-Cultural English Communication II	2
100245102	大学英语 II	College English II	2
100210016	国际贸易专业导论 II	Introduction to International Trade II	0.5
100210022	品德修养与成长 I	Ideological and Moral Cultivation and Growth I	0.15
Total Hours			**21.15**

Semester 3			Credits
100270003	马克思主义基本原理概论	Introduction to Basic Principles of Marxism	3
100172002	线性代数 B	Linear Algebra B	3
100210005	管理学原理	Principles of Management	2
100210025	宏观经济学	Macroeconomics	2
100210027	财务管理概论	Financial Management	2
100210009	职业生涯与人生规划 II	Career Development and life planning II	0.5
100070015	多媒体应用技术	Multimedia Technology	2
100960001	文献检索	Document Retrieval	1
100320003	体育 III	Physical Education III	0.5
100210075	国际经济学	International Economics	2
Elective	拓展英语 I	English for Specific Purposes I	2
Elective	文化素质类通识教育课	General Education	2
Elective	实践训练通识课	Lab Electives	2
Total Hours			**24**

Semester 4			Credits
100270004	毛泽东思想和中国特色社会主义理论体系概论	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics	4
100320004	体育 IV	Physical Education IV	0.5
100270008	形势与政策 II	Policy and Political Situation	0.5
100210029	管理运筹学	Management operational research	3
100171301	概率论	Probability	3
100210097	国际市场营销	International Marketing	3
100210028	应用统计学	Applied Statistics	2
100210038	经济法	Law for Economics	2
100210035	货币银行学	Monetary and Banking	2
Elective	拓展英语 II	English for Specific Purposes II	2
Elective	文化素质类通识教育课	General Education	2
Total Hours			**24**

Semester 5			Credits
100210219	社会实践	Humanities	2
100210023	品德修养与成长 II	Ideological and Moral Cultivation and Growth II	0.15
Elective	海外学期	Oversea Study	10
Total Hours			**12.15**

Semester 6			Credits
100210030	企业伦理与社会责任	Business Ethics and Corporate Social Responsibility	2
100210040	计量经济学	Econometrics	2
100270009	形势与政策 III	Policy and Political Situation III	0.5
100210039	国际贸易实务	Practice of International Trade	2
100210037	国际商法	International Business Law	2
100210036	国际金融	International Finance	2
Elective	专业教育选修课	Technical Electives	10
Total Hours			**20.5**

Semester 7			Credits
100210207	毕业实习	Internship	8
100210010	职业生涯与人生规划 III	Career Development and Life planning III	1
100270010	形势与政策 IV	Policy and Political Situation IV	0.5
100210183	专业社会实践	Study Project	2
100031314	制造技术基础训练 C	Basic Training in Manufacturing Technology C	2
100210146	应用经济学研究方法专题	Research Methodology in Applied Economics	1
100210087	国际贸易单证	International Trade Documents	1
100210147	国际贸易前沿问题专题	Advanced topics on Applied Economics	1
Total Hours			**16.5**

Semester 8			Credits
100210024	品德修养与成长III	Ideological and Moral Cultivation and Growth III	0.2
100210213	毕业设计（论文）	Graduation Project (Thesis)	12
Total Hours			**12.2**

Total Credit Hours **156**

Technical Electives			Credits
100210065	财政学	Public Finance	2
100210056	管理信息系统	Management Information System	2
100210073	跨文化管理	Cross-cultural Management	2
100210085	国际物流	International Logistics	2
100210042	人力资源管理	Human Resource Management	2
100210078	世界贸易组织	The World Trade Organization	2
100210079	经贸文章阅读	Business Readings	2
100210080	金融市场	Financial Market	2
100210082	国际商务环境	International Business Environment	2
100210083	世界经济	World Economy	2
100210084	证券投资学	Security and Investment	2
100210086	现代广告学	Modern Advertising	2
200210090	中级计量经济学	Advanced Econometrics	3
200210092	中级宏观经济学	Intermediate Macro-economics	2
200210091	中级微观经济学	Intermediate Micro-economics	2
200210089	国别经济	Country Economy	2
100210034	国际贸易	International Trade	2
100210007	市场营销学	Marketing	2
100210088	企业经营决策模拟	Business Simulation	2

Course Descriptions

100210005 Principles of Management

This course is an introductory level management course that deals with the principles of management theory and practice. This course provides instruction in principles of management that have general applicability to all types of organizations. Emphasis is placed on the functional approach including planning, organizing, leading, and controlling. To learn and understand the basic management principles in order to build a solid foundation for future career success. The goals of this course are to provide a broad base of knowledge about organizations, about the environments in which they operate and about the related roles and responsibilities of managers. This course will provide the opportunity to use this knowledge to develop specialized skills and competencies crucial to the successful leadership of modern organizations.

100210006 Microeconomics

Principles of Microeconomics is an introductory undergraduate course that teaches the fundamentals of microeconomics. This is the first course that undergraduates take in economics and it provides a foundation for many years of study in economics, business, or related fields, as well as for economic analysis and thinking that can last throughout their education and subsequent professional careers.

This course begins with an introduction to supply and demand and the basic forces that determine equilibrium in a market economy. Next, it introduces a framework for welfare economics and its applications. We then turn our attention to firms and their decisions about optimal production, and the impact of different market structures on firms' behavior.

100210007 Marketing

This course is a compulsory course for the bachelor's degree major in economics and management. It is to explore marketing operation and management, help the learners get to know the theories and the practical development of marketing, and know how to use the knowledge they have learned. The content of this course includes: brand decision, product decision, price decision, channel management, integrated marketing communication, marketing operation management and global marketing.

100210008/009/010 Career Development and Life Planning I, II, III

The series of courses introduce career development theories and methods; encourage college students to take the initiative in career development and life planning, help the students plan their careers and lives with their own characteristics; show the students how to present themselves in workplaces and protect themselves under certain circumstances.

100210015/016 Introduction to International Trade I, II

This introduction course is a basic course which prepares the students for the following professional courses. It introduces the nature of the profession and gives an overview of the knowledge system, the curriculum and course contents to the students, teaching them the learning methods. The course provides the students a basic understanding of the profession.

100210025 Macroeconomics

Macroeconomics is one of the professional basic courses in economics, which include economics, finance, financial management and related fiscal and economics courses. It is especially for undergraduate students who already have knowledge of higher mathematics and microeconomics. It is a subject that takes a country's macroeconomic performance as the main object of study, systematically introduces the knowledge of GDP, national accounts, national income determination model, as well as unemployment, inflation, theory of fiscal policy and monetary policy. The purpose is to enable students to understand the policies of national stability and economic adjustment under market system, to be able to link theory with practice, as well as to use knowledge learned in class to analyze real macroeconomic issues.

100210026 Fundamentals of Accounting

This course is a compulsory course for undergraduate students of economics and management. The main purpose is to enable students to master necessary accounting theory and the actual operation knowledge. Through the learning, the students should grasp the fundamental theory of accounting and the methods of operation, set up a solid foundation for the subjects of financial management and financial analysis.

100210027 Financial Management

Financial Management studies corporate finance and capital markets, emphasizing the financial aspects of managerial decisions. It touches on all areas of finance, including the valuation of real and financial assets, risk management and financial derivatives, the trade-off between risk and expected return, corporate financing and dividend policy. The course draws heavily on empirical research to help guide managerial decisions.

100210028 Applied Statistics

Applied Statistics is a methodological science for the study of data collection, collation and analysis. It is also an important tool to analyze quantitatively the objective phenomenon.

The main content consists of two parts:

One is to study the elementary statistics, including the collection of statistical data, collation and demonstration, description of the data distribution feature. According to the purpose of the study, data information can be effectively and fully extracted, inherent data quantity regularity can be probed;

The other is to apply statistical analysis in economics and management, including parameter estimation and hypothesis testing, variance analysis, correlation and regression analysis, time series analysis, analysis of statistical index, statistical synthesis evaluation, statistics and projections, and by using integrated application of all kinds of statistical methods to necessarily and properly analyze practical problems in various fields .

100210029 Management Operational Research

This course is to explore the method to design and analyze operational research. The objective of this course is to familiarize the students with the concepts and the process of management operational research. Students will be able to use operational research to solve practical problems.

100210030 Business Ethics and Corporate Social Responsibility

This course is compulsory for the bachelor’s degree major in economics and management. It is to explore problems that corporation meets with regard to ethics and social responsibility. It is to help learners be capable to find and solve the problems. Learners could also be able to adjust in conflicts between individual and organization. Contents includes: modern business ethics issues, business ethics in China and foreign countries, overview of social responsibility, theories and practice of social responsibility, corporate social responsibility report, human resource management and ethics, marketing and ethics, multinational operation and ethics, environmental responsibility and sustainable development, corporate operation in internet era and ethics.

100210034 International Trade

The course introduces theories of international trade and their applications. It is concerned with the effects upon economic activity of international differences in productive resources and consumer preferences and the institutions that affect them. It seeks to explain the patterns and consequences of transactions and interactions between the inhabitants of different countries, including trade, investment and migration. The aim of this course is to provide students with an understanding of the principles and applications of international trade, so that students will be prepared to face the future complexities of the world economy.

The course explores the theoretical foundations of International Trade, which focuses on why nations trade, what they trade, and how free trade can be beneficial or detrimental to trading countries. We will also discuss what governments can do to influence trade flows and how government policy can be used as a strategic tool by a country to achieve its own international objectives; the political debate surrounding such policies are also surveyed.

100210035 Monetary and Banking

This course is an introduction to the behavioral science of economics which focuses on interest rates, the concept of money, exchange rates, and monetary policy. Topics covered include banking structures and function, the Federal Reserve, determinants of the money supply, fiscal policy and monetary policy, and international economies.

100210036 International Finance

The purpose of this course is to provide students with a background on the international environment, then to focus on finance in an international setting. It includes foreign exchange, international monetary systems, financial markets, flow of capital, and financial institutions, risk management, etc. Students are living in a globalized world economy and it is essential for them to fully understand all dimensions of international finance. International Finance is not just about textbook learning; it prepares students for further study and/or subsequent professional careers.

100210037 International Business Law

An intensive introduction to the legal and ethical issues confronting the global business manager. This is an introduction to legal principles and their relationships to business organizations. Representative topics include the legal authority to regulate business, consumer law, employment and labor relations law, torts and crimes related to business, intellectual property, commercial transactions, and contract law. Examines product liability, the administrative legal process of regulation, and the contract as the fundamental legal instrument of global commercial relations. Course content will include applications of these legal principles to domestic and international issues as appropriate.

100210038 Law for Economics

This course is designed to explore the fundamental principles of international economic law and its relations to public international law and private international law. In addition, the course will give a general introduction to the legal systems of those related areas: international trade, international transportation and insurance, international investment, international finance, international taxation, protection of intellectual property rights, international commercial dispute settlement. The instructor will also comment on the current developments of those areas and the research methods concerning them.

100210039 Practice of International Trade
Practice of International Trade offers a comprehensive analysis of the complexities of an international sale transaction through case law, policy documents, legislation, international conventions and rules adopted by international organisations such as the ICC. Focusing on international sales of goods and the various contractual relations that arise as a result of the sale transaction, this course considers and discusses: the formation of a contract, standard trade terms, international transportation of cargo, insurance and payment mechanisms, letters of credit etc. The main and essential issues relating to the conclusion of an international sales of goods and the procedures of fulfilling of the contract.

100210040 Econometrics
Econometrics is the science (and art) of confronting economic models with data for the purposes of testing the models, predicting future events, or generating policy advice. Mathematically, we will be strongly relying on statistics: We will begin by refreshing our knowledge of probability theory, and much talk will be about regression coefficients and hypothesis tests. An important difference to "normal" statistics is the focus on economic data, which are typically not generated by proper experiments. As a result, statistical methods often need to be substantially adapted. Frequently, we will attempt to compensate for problems with data quality by using knowledge (or at least assumptions) from economic theory. This means that to do econometrics well, you need to know your economics and not just your statistics. At the same time, large parts of the course will be useful as statistics for social sciences more generally.

100210042 Human Resource Management
This course is a systematic study of human resource management, includes the theory of human resources, human resources management, the emergence and development of human resource management and human resource managers. The course focuses on specific issues of human resource management, such as job analysis, recruitment, training, performance evaluation, salary management, etc. Through the study of this course, the students can understand and master the basic theory and methods of human resource management, and improve their ability to analyze and solve the practical problems of human resource management.

100210056 Management Information System
This course is to help students understand how to appropriately utilize IT tools for the success of a business. Students will learn the major terminology used in the field of MIS and the IT tools for businesses. The course addresses both the strategic and technical parts of MIS, including the strategic and value-chain analysis before employing specific IT tools, different IT tools available for supporting different business strategies, e.g. Supply Chain Management (SCM), Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), database technology, Decision Support Systems (DSS), e-commerce and e-business, etc. Moreover, the topics of

systems development and implementation, as well the new trends of Information System at the scenario of Internet+ are also covered.

100210065 Public Finance
This course is to provide basic knowledge of the public finance for undergraduate students who major in economics.

100210073 Cross-Cultural Management
This course is an elective course for international economics and trade professionals. The main purpose of this course is to set forth the basic theory of culture, basic knowledge and basic methods of international cooperation and international business issues in cross-cultural analysis. Through the course, the students will be cultivated and improve their ability of international operations.

100210075 International Economics
The course introduces the theories of international economics and their application. It seeks to explain the patterns and consequences of transactions and interactions between the inhabitants of different countries, including trade, investment and migration. The aim of this course is to provide students with an understanding of the principles and applications of international economics, so that students will be prepared to face the future complexities of the world economy.
International economics explores the theoretical foundations of International Trade and Finance. The trade section focuses on why nations trade and how free trade can be beneficial or detrimental to trading countries. We will also discuss what governments can do to influence trade flows and how government policy can be used as a strategic tool by a country to achieve its own international objectives; the political debate surrounding such policies are also surveyed. The finance section will focus on balance of payments and market-determined exchange rates.

100210078 The World Trade Organization
The world trading system has undergone massive changes in the last sixteen years. The creation of the WTO and the development of enforceable international rules governing trade in services and intellectual property rights as well as trade in goods vastly expanded the scope and effectiveness of the system. The World Trade Organization (WTO) is the primary organization in the field of economic globalization. WTO law governs the rights of governments to regulate international trade in goods and services and requires them to protect intellectual property. The WTO has an active dispute settlement system which, since 1995, has produced a substantial jurisprudence. The aim of the course is to provide students with a theoretical and practical understanding of the regulatory framework of the world trading system, covering both the institutional and substantive law of the World Trade Organization (WTO), which has played a central role in promoting and regulating international trade liberalization since its establishment in April 1994.
Students will explore the key legal disciplines relating to international trade in goods and services, such as the non-discrimination principles, market access commitments and rules on dumping, subsidization and product standards. Students will then engage with other substantive areas of WTO law, such as the WTO Agreement on Trade in Services, the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights and the principle of special and differential

treatment of developing countries. In addition, students will consider how WTO law interacts with other areas of international law and the extent to which WTO members can use trade measures to pursue other (non-trade) values, such as environmental protection, the rights of WTO Members to protect public policy interests. A special theme is the role of developing countries within the WTO system.

100210079 Business Readings

The purpose of this course is to train students to master the basic skills of reading and understanding business English articles, master some of the common words in international economic articles, understand the general business expression, be familiar with the main types of business English articles, so as to further study the follow-up business English courses.

100210080 Financial Market

This course is fundamental for banking and some other disciplines, meanwhile it is relatively independent from the modern financial practice courses. The course covers the basic concepts and theories of the financial markets: the basic mode of operational methods; the basic structure and functions of the financial market, the basic law of operation and development; so as to enable the students analyze and practice in the financial market in China.

100210082 International Business Environment

This introductory course will introduce students to all areas of international business and the environment within which business transactions take place. The challenge is to compete successfully in the global marketplace as it exists today and develops tomorrow. The main topics covered in this course shall provide students with an understanding and appreciation of the following,

Evolution, definitions, patterns, forces, and linkages of international business;

Importance of International Business in the global economy;

Theories of international business, trade, and investment;

Importance of regional economic integration and emerging markets;

Legal, political, economic and cultural environment of global business;

Basic skills of operation, management, and control of global business;

Basic techniques of market research and foreign market entry strategies;

Contemporary issues in global business and their implications.

100210083 World Economy

This course is to provide students with understanding of historical evolution as well as the driving forces of the world economy. This course analyzes the major historical economic, political, and social changes in the world economy. The course covers: factors influencing the economic performance, the changes of the form of government, the evolution of technology (including industrialization), and episodes of integration and disintegration of the global economy. In the course, we discuss the existing and potential problems of the world economy, and the students will be led to formulate their own research according to their own interest.

100210084 Security and Investment

Securities and Investment provides students with the skills and guided practice which are necessary to master fundamental concepts in securities and investment. The course introduces the process of investment, contents include: financial markets, financial products, financial products pricing, financial investors' behavior and basic securities and investment techniques, etc. Recent investment theory will be used to analyze the trend of international financial market and the reform in China stock market.

100210085 International Logistics

International Logistics is an emerging discipline, the development trend of economic globalization increasingly rapid international logistics plays an important role in international trade. The essence of international logistics is the principle according to the international division of labor, in accordance with international practice, the use of international logistics network, logistics facilities and logistics technology, goods flow and international exchange in order to promote world optimal allocation of resources and economic development. Students are required to master the basic theory of logistics, based on the basic knowledge and basic skills on having a preliminary settlement of international logistics and distribution network optimization and logistics management program design. Focus on linking theory with practice, focusing on international logistics practices, aimed at improving students' independent thinking, problem solving, creative thinking ability and specific skills.

100210086 Modern Advertising

This course is to explore one of the obvious marketing functions and its applications in advertising practice in the real world of business development in this age of globalization. Students are designed to know how modern advertising should be understood, and how in practice such activities of marketing management has to be operated well with the other functions in integrated marketing communications for special business to grow in a long-run sustainable way. Advertising theories, concepts, framework, models and methods will be introduced, discussed and analyzed. Learners are required to participate in in-class discussions, individual presentations and team work projects during the whole process of the course.

100210087 International Trade Documents

This course introduces the basic types of international trade documents and their application, and develops students' capability to manage and conduct documents in practice. The course explores concepts, theories and practice of International Trade Documents, which focuses on types, roles, procedure and practice of international trade documents. Students are expected to understand the concept, theory and international practice in international trade documentation practice, and to making flexible use in various scenarios.

100210088 Business Simulation

This course is designed to immerse you in the challenges faced by the managers venturing in the markets. We will explore the key activities undertaken by the managers: evaluate new market opportunities, develop market entry strategies and effectively manage expansion in international markets. We will consider the essential strategic, organizational challenges and managerial issues encountered by international managers, associated with different modes of entry.

An important component of this course is: the students will work in teams to devise a global expansion strategy, and then execute this strategy through a computer-based simulation game called CESIM Global Challenge. Through simulation exercises, a team will plan and implement its firm's value chain activities across three regions as international expansion, while the other teams are attempting to compete in those same markets.

100210097 International Marketing

This course is designed to help the student to develop the basic skills required to make optimal marketing decisions in an international setting. Topics include the environment of international marketing, market research, product and brand management, pricing strategies, logistics and supply chain management, promotional strategies.

100210146 Research Methodology in Applied Economics

This course is based on a brief presentation on applied economics research methodology. Through its operational analysis training, the students have the ability to issue a preliminary empirical analysis, subsequent to the completion of dissertation writing.

100210147 Advanced Topics on Applied Economics

This course is to explore the advanced topics in applied economics to senior students majoring in international economics and trade.

100210183 Study Project

Study project is an in-depth practice after the completion of the curriculum. It is an important link for students to achieve the goal of learning international trade. It is also an important part of the comprehensive study. Through the combination of theory and practice, the project further improve the students' abilities to observe the practical problem and apply appropriate method to analyze and solve the problem.

100210207 Internship

This course is to apply accounting theories in practice thus to enhance students' ability of analyzing and solving actual problems. By practicing accounting skills such as recording, managing corporate finance and auditing in the real world, the students will get further understanding of accounting and financial works. This course will help to connect the knowledge learned from school with the real world, and thus set a grounded basis for working after graduation. At the meanwhile, students could also collect resources necessary for their research during their internship.

100210213 Graduation Project (Thesis)

This course is a key process of university education. It reflects a student's overall ability. By writing thesis, a student should master the ability to analyze a problem by using related theories and methods, the ability to resolve problems using proper methods, the ability to search and review literature and materials, and the ability of written and oral presentation.

100210219 Humanities

Through the social survey related to the international trade professional, the students should have an overview of the profession in both domestic and international circumstances, understand the needs for the training and be familiar with the business requirements and the work content in trade.

Course Syllabus

100210005 Principles of Management

Lecture Hours: 32
Credits: 2
Term (If necessary): First year, first semester
Prerequisite(s): None

Course Description:

This course is an introductory level management course that deals with the principles of management theory and practice. This course provides instruction in principles of management that have general applicability to all types of organizations. Emphasis is placed on the functional approach including planning, organizing, leading, and controlling. To learn and understand the basic management principles in order to build a solid foundation for future career success. The goals of this course are to provide a broad base of knowledge about organizations, about the environments in which they operate and about the related roles and responsibilities of managers. This course will provide the opportunity to use this knowledge to develop specialized skills and competencies crucial to the successful leadership of modern organizations.

Course Outcomes:

After completing this course, a student should be able to:
Develop a preliminary overview of the field of Management for business majors.
Analyze practical problems and phenomena associated with corporate operations.
Use the principles of management to analyze and solve specific issues of organizations.

Course Content:

Lectures and Lecture Hours:

1. Introduction to management 4
   - The definition of Management
   - Characteristics of Management
   - The role and application of management
   - Enterprises
2. Evolution of Management Thought 4
   - Evolution of Management Thought
   - Ancient Management Thought
   - Taylor's Scientific Management
   - Fayol's General Management
   - Mayo's Human relations theory
   - Modern management thinking
3. Planning and decision-making 4
   - Definition and nature of planning
   - Types of plan
   - Planning process

- Common planning methods
- Decision making

4. Organizing 4
- Definition of organization and environment
- Type of organization
- Purpose and process of organization design
- Type of organizational structure
- Organization Design Principles
- Organizational Change
- Organizational Innovation

5. Leadership 4
- Definition of leadership
- Humanity Hypothesis
- Several typical leadership theory
- Leadership and decision-making
- Leadership and employment

6. Motivation 4
- Definition of Motivation
- Motivation Theory
- Motivation Practices

7. Coordination 4
- Group
- Conflict
- Communication
- Relationships

8. Control 4
- Definition of control
- Process of Control
- Types of control
- Implementation of effective control
- Control methods
- Typical areas of control

Grading:

Homework	20%
Inclass Quizzes	20%
Final Exams	60%

Text & Reference Book:

Qiao Zhong, Zhou Biwen. Management 3rded． Beijing: China Machine Press, 2015.

100210006 Microeconomics

Lecture Hours: 48
Laboratory Hours: 0
Credits: 3
Prerequisite(s): None

Course Description:

Microeconomics is an introductory undergraduate course that teaches the fundamentals of microeconomics. This is the first course that undergraduates take in economics and it provides a foundation for many years of study in economics, business, or related fields, as well as for economic analysis and thinking that can last throughout their education and subsequent professional careers.

This course begins with an introduction to supply and demand and the basic forces that determine equilibrium in a market economy. Next, it introduces a framework for welfare economics and its applications. We then turn our attention to firms and their decisions about optimal production, and the impact of different market structures on firms' behavior.

Course Outcomes:

After completing this course, a student should be able to:
Understand general economic and microeconomic terminology, concepts, and theories;
Develop a range of skills enabling them to analyze general microeconomic problems;
Understand how to apply economic principles to a range of policy questions;
Use logical economic reasoning to analyze real-world situations and events;
Understand price theory, elasticity and market dynamics;
Use supply and demand diagrams to analyze the impact of overall changes in supply and demand on price and quantity;
Understand producer and consumer surplus and market efficiency;
Utilize these concepts to analyze taxation and international trade;
Understand government role regarding business;
Analyze different types of market structures, including perfect competition, monopoly, oligopoly and monopolistic completion;
Learn basic knowledge of how to manage the resources of an organization to meet goals.

Course Content:

Lectures and Lecture Hours:

1. Introduction 1
    - Ch 1. Ten Principles of Economics 1
    - Ch 2. Thinking like an Economist 2
    - Ch 3. Interdependence and the gains from trade 2
    - Ch 4. The market forces of supply an demand 4
2. Workshop 1
    - Ch 5. Elasticity and its application 4
      Case Study
3. Workshop 2

- Ch 6. Supply, demand and government policies 2
  Case Study
- Ch 7. Consumer, producer, and the efficiency of markets 2
- Ch 8. The cost of taxation 2
  Case Study
- Ch 9. International Trade 2
- Ch 10. Externalities 4
  Case Study
- Ch 11. Public goods and common resources 2
  Case Study
- Ch 13. The costs of production 4

4. Workshop 3

- Ch 14. Firms in the competitive markets 4
  Case Study
- Ch 15. Monopoly 2
- Ch 16. Oligopoly 4
  Case study
- Ch 17. Monopolistic competition 4
  Workshop 4
- Ch 18. The Markets for the Factors of Production 2

Grading:

Class attendance & performance	5%
Written homework	8.33%
Group presentation	8.33%
Online quizzes & exercises	8.33%
Final exam	70%

Text & Reference Book:

[1]N. Gregory Mankiw, Principles of Microeconomics, 6e, Higher Education Press, 2014, ISBN：9787040290134
[2]N. Gregory Mankiw, Principles of Microeconomics, 6e, Cengage Learning, 2012, ISBN: 9780538453042
[3]N. Gregory Mankiw, Study Guide for Mankiw's Principles of Microeconomics, 6e, Cengage Learning, 2011, ISBN: 9780538477451

100210007 Marketing

Lecture Hours: 32
Laboratory Hours: 0
Credits: 2
Prerequisite(s): **Principles of Management**

Course Description:

This course is a compulsory course for the bachelor's degree major in economics and management. It is to explore marketing operation and management, help the learners get to know the theories and the practical development of marketing, and know how to use the knowledge they have learned. The content of this course includes: brand decision, product decision, price decision, channel management, integrated marketing communication, marketing operation management and global marketing.

Course Outcomes:

After completing this course, a student should be able to:

Get to know and understand the meaning and characteristics of marketing, the principles and core of marketing operation and management, the development and trend of marketing theories and practice.

Utilize the theories in a right way to find the problems in marketing operation and management.

Be capable to analyze and solve problems in marketing operation and management.

Course Content:

Lectures and Lecture Hours:

1. Marketing in 21st century 2
  - Categories and characteristics of marketing
  - Change of marketing concept
  - Process in marketing management and value realization
  - Cultivating customer relationships
2. Marketing environment 2
  - Overview
  - Macro-environment
  - Micro-environment
  - Integrated analysis methods
3. Purchase behavior in market 3
  - Customer purchase behavior
  - Organization purchase behavior
4. Market research 3
  - Overview
  - Qualitative methods
  - Quantitative methods
  - Public policies and morality
5. STP 2
  - Market segmentation
  - Target market
  - Market positioning
6. Brand decision 2

- Categories and value
- Branding decision
- Brand assets building

7. Product decision 4
- Product overview
- Product portfolio
- Product lifecycle
- Development decision of new product
- Services marketing

8. Price decision 2
- Influencing factors of pricing
- Pricing procedure and methods
- Pricing strategies
- Price adjustment
- Public policies and pricing

9. Channel decision 4
- Channel overview
- Channel designing
- Channel management
- Trends of channel innovation

10. Integrated marketing communication 4
- Design and management of marketing communication
- Mass communication mode and management
- Interpersonal communication mode and management
- Social responsibility and ethics in marketing communication

11. Marketing operation management 2
- Marketing planning
- Marketing organization
- Marketing controlling

12. Global marketing 2
- Overview of global market
- Global marketing environment
- Accessing way to global market
- Global marketing management decision

Grading:

Prerequisite quiz 40%

(Research reports: 10%+10%; Case study report: 10%; Instructor evaluation: 10%)

Final 60%

Text & Reference Book:

Text book:

王月辉、冯艳、杜向荣编著.市场营销学[M]，北京:北京理工大学出版社，2016,09

Reference book:

[1]菲利普-科特勒等著,楼尊译.市场营销原理与实践（第 16 版）[M]，北京:中国人民大学出版社，2015,08

[2]迈克尔-R-所罗门等著，罗立彬等译.市场营销学（第 7 版）[M]，北京:电子工业出版社，2013,10

[3]吕一林等编著.市场营销学[M]，北京:中国人民大学出版社，2014,11

100210008/009/010 Career Development and Life Planning I, II, III

Lecture Hours: **32**
Credits: **0.5/0.5/1**
Prerequisite(s): **None**

Course Description:

The series of courses introduce career development theories and methods; encourage college students to take the initiative in career development and life planning, help the students plan their careers and lives with their own characteristics; show the students how to present themselves in workplaces and protect themselves under certain circumstances.

Course Outcomes:

After completing the courses, a student should be able to:
Understand the career development and relevant theories;
Analyze the career development cases with appropriate theories and methods, and do self-reflection;
Present themselves well;
Communicate well with others and know how to protect themselves.

Course Content:

Lectures and Lecture Hours:

1. Introduction 4
   - Career and career development
   - Career development theory
   - Life planning
2. Self Awareness 4
   - Original family
   - Self reflection
3. Self Development 4
   - Interpersonal relation
   - Communication skill
4. Self Presentation 4
   - Presentation skills
   - Resume making
5. Self Enhancement 8
   - Individual and organization
   - Career management
   - Knowledge management
   - Time management
6. Self Protection 8
   - Complexity in career development
   - Psychological capital - resilience
   - Risk management

- Self protection

Grading:

Attendance and Participation	15%
Homework	30%
CV / Personal Resume	15%
Final Report	40%

Text & Reference Book:

Liu P. Q., Lu Y. Q., and et al. Career Development and Life Planning [M]. Beijing: Peking University Press, 2014.

100210015/016 Introduction to International Trade I, II

Lecture Hours: **16**
Credits: **1**
Prerequisite(s): **NA**

Course Description:

This introduction course is a basic course which prepares the students for the following professional courses. It introduces the nature of the profession and gives an overview of the knowledge system, the curriculum and course contents to the students, teaching them the learning methods. The course provides the students a basic understanding of the profession.

Course Outcomes:

After completing this course, a student should:
1. Understand international economics and trade as a profession;
2. Understand the knowledge system of international economics and trade;
3. Master the learning methods of the profession;
4. Understand the relation between national economy and international economics and trade.

Course Content:

Lectures and Lecture Hours:

- overview of international economics and trade
- nature, characteristics and professional characteristics
- the international economics and trade professional training objectives and curriculum design ideas
- study method

Grading:

Project	50%
Group Presentation	25%
Class attendance	25%

Text & Reference Book:

Wei Long, Huang Hanmin: Introduction to international economics and trade, Wuhan University of Technology press, April 2011

100210025 Macroeconomics

Lecture Hours: 32
Laboratory Hours: 0
Credits: 2
Prerequisite(s): Microeconomics

Course Description:

Macroeconomics is one of the professional basic courses in economics, which include economics, finance, financial management and related fiscal and economics courses. It is especially for undergraduate students who already have knowledge of higher mathematics and microeconomics. It is a subject that takes a country's macroeconomic performance as the main object of study, systematically introduces the knowledge of GDP, national accounts, national income determination model, as well as unemployment, inflation, theory of fiscal policy and monetary policy. The purpose is to enable students to understand the policies of national stability and economic adjustment under market system, to be able to link theory with practice, as well as to use knowledge learned in class to analyze real macroeconomic issues.

Course Outcomes:

After completing this course, a student should be able to: Understand and master the basic principles, knowledge and concepts of macroeconomics;
Master the basic research methods of macroeconomics;
Understand and evaluate correctly macroeconomic theory;
Develop and improve the capability to use the knowledge to solve economic problems.

Course Content:

Lectures and Lecture Hours:

1. Introduction 2
   - Creation and development of Macroeconomics
   - Research methods of Macroeconomics
   - Basic problems of Macroeconomics
2. National Income Accounting 4
   - Analysis of the concept of Gross Domestic Product
   - Accounting method of national income
   - Model of national income circulation and identical equation national income
   - Relationship of the concepts related with national income
3. Theory of simple decision of national income: AE-NI model 4
   - Decisive principle of national income equilibrium
   - Keynes' consumption theory
   - Decision and change of national income
   - Multiplier theory
4. General equilibrium of product and money markets: IS-LM model 4
   - Decision of investment
   - Decision of interest rate

- Equilibrium of money market: LM curve
- Equilibrium of product market: IS curve
- IS-LM model
- Basic theoretical frame of Keynes

5. Analysis of macroeconomic economic policies 4
   - Instruments and objectives of macroeconomic policies
   - Validity of fiscal and monetary policies
   - Cooperative usage and discretionary choice of fiscal and monetary policies
6. Analysis of total demand and total supply: AD-AS model 4
   - Total demand
   - Total supply
   - Analysis of total demand and supply
   - Price level and macroeconomic policies: the effectiveness of macroeconomic policies under AD-AS frame
7. Underemployment and Inflation 4
   - Description of underemployment
   - Influence of underemployment and the Okun's law
   - Economic explanation of underemployment
   - Description of inflation
   - Reason of inflation
   - Relationship of underemployment and inflation--the phillips curve
   - Regulation of inflation
8. Practice of macroeconomic polices 2
   - Fiscal policies
   - Monetary policies
   - Historical review of macroeconomic policies in China
9. Group presentation of project research 4

Grading:

Mini-quiz	10%
Homework (Project research)	10%
Group Presentation	10%
Final closed-book exam	70%

Text & Reference Book:

Macroeconomics, 2th ed., 2016, Qinghua University Publishing House.

100210026 Fundamentals of Accounting

Lecture Hours: **32**
Credits: **2**
Prerequisite(s): Principles of management

Course Description:

This course is a compulsory course for undergraduate students of economics and management. The main purpose is to enable students to master necessary accounting theory and the actual operation knowledge. Through the learning, the students should grasp the fundamental theory of accounting and the methods of operation, set up a solid foundation for the subjects of financial management and financial analysis.

Course Outcomes:

After completing this course, a student should be able to:
Master the basic accounting knowledge;
Perform analysis on business accounting, solve practical accounting problems in the enterprises;
Do the preparatory work for financial statements;
Master the whole procedure of accounting treatment.

Course Content:

Lectures and Lecture Hours:

1. General introduction 6
   -definitions, functions and objectives of accounting
   -accounting objects and accounting elements
   -basic principles of accounting
2. Accounts subjects and accounts 2
   - accounting subjects
   - Accounting
3. Double accounting principle and its application 4
   - double accounting principle
   - debit and credit accounting method
4. Accounting document 2
   - overview of accounting documents
   - original document
   - accounting documents
5. The accounting books 4
   - overview of accounting books
   - accounting books setup and accounting rules
   - accounting books setup and registration
   - correction of the wrong account and parallel registration
6. Accounting treatment of the main business 6
   - accounting treatment of capital
   -accounting treatment of preparation of production activities
   -accounting treatment of producing

- accounting treatment of sales
- accounting treatment of investment
- accounting treatment of period cost
- accounting treatment of profit and distribution

7. Preparation of the accounting statement 4
   - property inventory
   - overview of accounting statement
   -asset and debt balance sheet
   - profit statement
8. Accounting procedure 2
   - overview of accounting procedure
   - procedures of accounting documents
   -procedures of summary accounting
   -procedures of subject summary
9. Discuss, question and review 2

Grading:

Homework	10%
Inclass performance	10%
Attendance	10%
Final exama	70%

Text & Reference Book:

Textbooks:

Zhu Xiaoping, Xu Hong, Zhou Hua, *Primary accounting*, 7th Edition, China Renmin University Press, February 2015.

Reference book:

[1] Zhu Xiaoping, Xu Hong *The guide book of elementary accounting*, 7th edition [M]. Beijing: China Renmin University Press, 2015.

Outline Description:

(1) This syllabus is based on *Fundamentals of Accounting* edited by the teaching guidance committee of Ministry of Education, with the consideration of our teaching demands for reform.

(2) The syllabus for undergraduate accounting.

(3) Under the premise to ensure the basic teaching requirements, teachers can adjustments and delete based on the actual situation.

100210027 Financial Management

Lecture Hours: **32**
Credits: **2**
Prerequisite(s): **Financial Accounting, Business Management, Financial Economics**

Course Description:

Financial Management studies corporate finance and capital markets, emphasizing the financial aspects of managerial decisions. It touches on all areas of finance, including the valuation of real and financial assets, risk management and financial derivatives, the trade-off between risk and expected return, corporate financing and dividend policy. The course draws heavily on empirical research to help guide managerial decisions.

Course Outcomes:

After completing this course, a student should be able to:
Understand what finance is;
Understand time value of money;
Understand valuation and pricing
Know the Risk Management, Option Strategies, Black-Scholes Model, Implied Volatility.

Course Content:

Lectures and Lecture Hours:

1. Introduction	2
-Principles Of Valuation	2
3. Evaluating Projects (1)	2
4. Case Study	2
5. Evaluating Projects (2)	2
6. Firm Valuation (1)	2
7. Firm Valuation (2)	2
8. Case Study	2
9. Introduction to Risk and Return	2
10. Portfolio Theory	2
-CAPM	1
11. Discount Rates in Practice	1
-Case Study	1
12. Raising Capital	2
13. Capital Structure	2
14. Investment theory	2
-Market Efficiency	1
15. Option	1
-Future	1
16. Final Exam	2

Grading:

cases and problem sets	(45%)
final exam	(40%)
class participation	(15%)

Text & Reference Book

Ross. Corporate Finance, China Machine Press, 2016.

100210028 Applied Statistics

Lecture Hours: 32
Credits: 2
Prerequisite(s): **Probability and Mathematical Statistics**

Course Description:

Applied Statistics is a methodological science for the study of data collection, collation and analysis. It is also an important tool to analyze quantitatively the objective phenomenon.

The main content consists of two parts:

One is to study the elementary statistics, including the collection of statistical data, collation and demonstration, description of the data distribution feature. According to the purpose of the study, data information can be effectively and fully extracted, inherent data quantity regularity can be probed;

The other is to apply statistical analysis in economics and management, including parameter estimation and hypothesis testing, variance analysis, correlation and regression analysis, time series analysis, analysis of statistical index, statistical synthesis evaluation, statistics and projections, and by using integrated application of all kinds of statistical methods to necessarily and properly analyze practical problems in various fields.

Course Outcomes:

By completing this course, the students will be able to do:

1. Systematically learn some basic statistical methods, and understand the statistical way of thinking;
2. Learn the different characteristics of the various statistical methods, application conditions and scope of applications;
3. Students can conduct right statistical analysis by applying statistical methods, using statistics software like SPSS and Excel, combining with the specific socio-economic and management issues.

Course Content:

Lectures and Lecture Hours:

1. Introduction 1
   - Generation and development of statistics
   - Objects and methods of statistics
   - Some basic concepts of statistics
   - Types of statistics data
2. Collecting statistical data and introduction of relative software 1
   - Basic issues of collecting statistical data
   - Statistical survey system
3. Collating statistical data 4
   - The meaning and process of collating statistical data
   - Statistics classification
   - Distribution series
   - Presenting statistical data
   - Dissertation of statistical analysis function in SPSS and Excel
4. Describing the data distribution characteristics 4

- Absolute indicators and relative indicators
- Describing indicators for degree of data distribution concentration
- Describing indicators for degree of data distribution dispersion
- Skewness and kurtosis of data distribution

5. Sampling and estimation of parameters 4
   - Basic concepts of sampling distribution
   - Sampling distribution theory
   - General principles of parameter estimation
   - Confidence Interval estimation in different sampling
6. Hypothesis testing 3
   - Basic concepts of hypothesis testing
   - Basic process of hypothesis testing
   - Testing population mean
   - Testing population proportion
7. Analysis of variance 3
   - Basic issues of analysis of variance
   - One-way analysis of variance
   - Two-way analysis of variance
8. Correlation and regression analysis 4
   - Basic issues of correlation and regression analysis
   - Analyzing the correlation
   - Simple linear regression
   - Multiple linear regression
9. Time-Series analysis 4
   - Basic issues of time-series analysis
   - Basic analysis index of time-series
   - Analysis on the change tendency of time-series
10. Statistical Index numbers 4
   - Basic issues of Index numbers
   - Building up total index numbers
   - Index numbers system
   - Several common economic index numbers

Grading

Attendance	10%
Homework	10%
Teamwork	20%
Final exam	60%

Text and Reference Books

Text:

H.Y. Li, S.F. Xiao&Y.Wang. Statistics: Data Analysis in Economics and Management [M].Beijing: China Statistics Press, 2014.

Reference Books:

J.P. Jia.Statistics (Fifth Edition) [M]. Beijing: Renmin University of China Press, 2014.

X.Z. Wu Statistics: From the Data to Conclusion (Fourth Edition) [M].Beijing: China Statistics Press, 2013.

[3] Statistics for business & economics McClave, J.T., Benson, P.G., & Sincich, T. 2014., 12th International ed., Singapore: Pearson Education, Inc.

100210029 Management Operational Research

Lecture Hours: **48**
Laboratory Hours: **0**
Credits: **3**
Prerequisite(s): **None**

Course Description:

This course is to explore the method to design and analyze operational research. The objective of this course is to familiarize the students with the concepts and the process of management operational research. Students will be able to use operational research to solve practical problems.

Course Outcomes:

After completing this course, a student should be able to:

1. Master the basic operation of management operational research;
2. Develop the ability of using management operational research software to solve problems;
3. Design technical solutions according to the analysis work.

Course Content:

Lectures and Lecture Hours:

1. The Introduction 4
   - Decision making, quantitative analysis and management of operational research
   -The branch of operational research
   -Operations research applications in business management
   -How to learn operations research
2. 2. The graphic method of linear planning 4
   -Problems
   -The graphic method of linear planning
   -The graphic method of sensitivity analysis
3. Computer to solve linear programming problems 4
4. Linear programming application in business administration 4
   -Human resource allocation problem
   -The production plan
   -Suit cut cutting problem
   -Batching problem
   -Investment issues
5. Simplex method 4
6. Transportation problem 4
   -Modeling
   -Computer solution
   -Application
7. Integer programming 4
   -Graphic method of integer programming
   -Computer solving integer programming
   -The application of integer programming
8. Dynamic programming 4

9.	Inventory theory	4
10.	Queuing theory	4
11.	Decision analysis	8

Laboratories and Laboratory Hours: **0**

Grading:

Homework	30%
Final	70%

Text & Reference Book:

Management Operational Research, HanBotang, Higher education press

100210030 Business Ethics and Corporate Social Responsibility

Lecture Hours: **32**
Laboratory Hours: **0**
Credits: **2**
Prerequisite(s): **Principles of Management**

Course Description:

This course is compulsory for the bachelor's degree major in economics and management. It is to explore problems that corporation meets with regard to ethics and social responsibility. It is to help learners be capable to find and solve the problems. Learners could also be able to adjust in conflicts between individual and organization. Contents include: modern business ethics issues, business ethics in China and foreign countries, overview of social responsibility, theories and practice of social responsibility, corporate social responsibility report, human resource management and ethics, marketing and ethics, multinational operation and ethics, environmental responsibility and sustainable development, corporate operation in internet era and ethics.

Course Outcomes:

After completing this course, a student should be able to:
Know how to apply business ethical principles and behave in a corporation.
Understand what the corporate social responsibility is, the evaluation criteria, the social requirements and how to make decision.
Be capable to identify and solve problems with regard to business ethics and social responsibility during corporate operation and management.

Course Content:

Lectures and Lecture Hours:

1. Modern business ethics 2
   - Categories and characteristics
   - Judgement and decision
   - Building modern corporate ethics
2. Business ethics in china and foreign countries 2
   - Ethics based on Confucianism
   - Ethics based on capitalism
3. Social responsibility overview 4
   - Connotation and characteristics
   - History and development
   - International social responsibility guide and criterion
   - Content
4. Social responsibility theories and practice 4
   - Social responsibility strategy
   - Corporate social responsibility development index in China
   - Evaluation
   - Status and trend

5.	Corporate social responsibility report – Development history and effect – Content and structure	2
6.	Human resource management and ethics – Principles, criteria and level in humanistic management – Recruitment and dismission management ethical issues – Career management ethical issues	3
7.	Marketing and ethics – Ethical issues of product – Ethical issues of pricing – Ethical issues of channel – Ethical issues of communication – Ethical issues of services	3
8.	Multinational operation and ethics – Economic globalization and multinational corporations – Ethical criteria in multinational operation – Ethical issues in multinational corporations	4
9.	Corporate environmental responsibility and sustainable development – Development history of corporate environmental responsibility – New development patterns of sustainable development – Best management practice of environmental responsibility	4
10.	Corporate operation in internet era and ethics – Development and characteristics of internet era – Ethical issues in internet era – Ethics management in internet era	4

Grading:

Prerequisite quiz : 40% (History research reports: 10%; case study reports on responsibility and ethics: 10%+10%; Instructor evaluation: 10%)

Final: 60%

Text & Reference Book:

Text book:

黄少英主编.企业伦理与社会责任[M]，大连:东北财经大学出版社，2015,02

Reference book:

[1]. O.C 费雷尔等著,李文浩等译.企业伦理学（第 10 版）[M]，北京:中国人民大学出版社，2016,01

[2]. 安德鲁-C.威克斯等著.商业伦理学管理方法[M]，北京:清华大学出版社，2015,05

[3].周祖城编著.企业伦理学（第 3 版）[M]，北京:清华大学出版社，2015,08

100210034 International Trade

Lecture Hours: **32**
Credits: **2**
Prerequisite(s): **100210006 Microeconomics**

Course Description:

The course introduces theories of international trade and their applications. It is concerned with the effects upon economic activity of international differences in productive resources and consumer preferences and the institutions that affect them. It seeks to explain the patterns and consequences of transactions and interactions between the inhabitants of different countries, including trade, investment and migration. The aim of this course is to provide students with an understanding of the principles and applications of international trade, so that students will be prepared to face the future complexities of the world economy.

The course explores the theoretical foundations of International Trade, which focuses on why nations trade, what they trade, and how free trade can be beneficial or detrimental to trading countries. We will also discuss what governments can do to influence trade flows and how government policy can be used as a strategic tool by a country to achieve its own international objectives; the political debate surrounding such policies are also surveyed.

Course Outcomes:

After completing this course, a student should be able to:

Describe the differences between international and domestic transactions.

Outline the contributions of different schools of international trade to our understanding of trade and its determinants.

Account for the increased importance of new forms and patterns of trade in world economy.

Outline the main ways in which governments regulate trade and explain their effects on national and global economic welfare.

Describe the main types of regional trading agreements entered into by countries, such as free trade areas, customs unions, economic unions and their effects.

Outline and explain the nature of the rules-based system of trade that has existed since the 2nd World War and the role played by multilateral economic institutions, such as the World Trade Organisation (WTO) in the regulation of trade.

Outline and explain the nature of foreign direct investment related to the mobility of capital and labor.

Course Content:

Lectures and Lecture Hours:

1. World Trade and the National Economy 4
   - Definition
   - What is Unique about International Economics
   - International Transactions-An Empirical Glimpse
   - Foreign Trade in the National Economy
   - Forums for Trade and Monetary Issues
2. Why Nations Trade 4

- The Principle of Comparative Advantage
- Comparative Opportunity Cost
- Absolute Advantage and Wage Rates
- Summary of Policy Implications
- Dynamic Gains from International Trade

3.	The Commodity Composition of Trade	4

- The Factor proportions Theory
- Alternative Theories
- An Emerging Consensus
- Economic Adjustment to Changing Circumstances

4.	Protection of Domestic Industries: The Tariff	6

- Some Institutional Considerations
- Economic Effects of the Tariff
- How protective is the tariff
- Arguments for Protection
- Approaches to Free Trade

5.	Nontariff Barriers to Trade	6

- Import Quotas
- Voluntary Export Restraints
- International Commodity Agreements
- International Cartels
- Local Content Requirement
- Border Tax Adjustments
- Dumping
- Export Subsidies
- NTBs versus Tariffs
- Strategic Trade Policy

6.	Regional Trading Agreement	2

- Regionalism
- Multilateralism

7.	Trade and Developing Countries	2

- Alternative Trade Approaches to Development
- The U. N. Conference on Trade and Development
- The Generalized System of Preferences (GSP)

8.	International Mobility of Productive Factors	4

- Motives for Direct Investment Abroad
- Foreign Investments and Economic Welfare (Real Income)
- International Trade Theory and the Multinational Corporation
- International Migration of Labor
- Globalization and the Outsourcing Controversy

Grading:

Attendance	10%
Homework	10%
Case Analysis	10%
Final Exam	70%

Text & Reference Book:

Mordechai E.Kreinin, Don P.Clark. International Economics: A Policy Approach, 2nd ed., 2015, ISBN 978-7-301-262542

Krugman, P., M. Obstfeld, and M. Melitz. International Economics: Theory and Policy, 9th ed., 2012, ISBN-13: 9780132744836

Robert J. Carbaugh. International Economics, 11th ed., 2010, ISBN 9781439038949

100210035 Monetary and Banking

Lecture Hours: **32**
Credits: **2**
Prerequisite(s): Microeconomics, Macroeconomics, Financial Management

Course Description:

This course is an introduction to the behavioral science of economics which focuses on interest rates, the concept of money, exchange rates, and monetary policy. Topics covered include banking structures and function, the Federal Reserve, determinants of the money supply, fiscal policy and monetary policy, and international economies.

Course Outcomes:

Upon successful completion of the course, the student should be able to display an understanding of news relating to monetary policies reported in such publications as The Wall Street Journal. Students will also become familiarized with the structure and function of Commercial Banks, the Federal Reserve, and other financial institutions such as the New York Stock Exchange. Further, students are expected to master techniques relating to interest rate calculations, exchange rate determinations, and appropriate levels of the Money Supply. This course should be a step in developing students' abilities to work in the financial or banking sector, along with giving all students an increased appreciation of how the economy works.

Course Content:

Lectures and Lecture Hours:

Intro: Definitions - Introduction and Chapter 1,	1
Overview and Money-Chapters 2 & 3	2
Interest Rates - Chapters 4,5	2
Interest Rates and Risk – Chapters 5 & 6	3
Financial Structure - Chapter 8	2
Banking - Chapter 10	3
Banking and Regulation -Chapter 11 & 12	3
Regulation and Crisis -Chapters 12 & 9	2
Crisis and The Federal Reserve: Chapter 9 & 13	2
The Federal Reserve –Chapter 13	2
Money and Monetary Policy–Chapter 14	4
Policy: Fed's Tools - Chapter 15	2
Advanced Policy – Chapter 16	2
International Finance and Exchange Rate -Chapter 17	2

Grading:

Project	15%
Group Presentation	15%
Final	70%

Text & Reference Book:

Mishkin, Frederic, The Economics of Money, Banking, and Financial Markets, 10th Edition, Addison-Wesley

100210036 International Finance

Lecture Hours: **32**
Laboratory Hours: **0**
Credits: **2**
Prerequisite(s): **Money and Banking, Macroeconomics**

Course Description:

The purpose of this course is to provide students with a background on the international environment, then to focus on finance in an international setting. It includes foreign exchange, international monetary systems, financial markets, flow of capital, and financial institutions, risk management, etc. Students are living in a globalized world economy and it is essential for them to fully understand all dimensions of international finance. International Finance is not just about textbook learning; it prepares students for further study and/or subsequent professional careers.

Course Outcomes:

After completing this course, a student should be able to:
Understand the determinants of currency prices and explain how these prices change in the foreign exchange (FX) markets
Distinguish how various exchange rate systems affect currency prices in the FX market
Explain how a country's balance of payments affect currency prices in the FX markets
Explain international parity conditions which link the prices of goods, interest rates, spot rates and forward rates throughout the world
Explain the nature and source of exchange rate exposure
Explain ways in which national, international, political and economic events impact exchange rate exposure for domestic and multinational corporations
Explain how exchange rate exposure may create risks and opportunities for domestic and multinational firms
Compare and contrast the basic characteristics of various financial instruments in the currency markets (e.g. spot, forward , futures, options contracts, and swaps)
Use various financial instruments to earn speculative profits, or hedge against exchange rate exposure
Given a firm's nature of business and operating environment, evaluate the level of exchange rate exposure that firm may have
Use various strategies to manage a firm's exchange rate exposure

Course Content:

Lectures and Lecture Hours:

Introduction	2
Foreign exchange and FX rate	2
Fixed and floating exchange rate regime	4
Relations between the exchange rate and the economy	2
Exchange rate theories	2
Foreign exchange control and RMB exchange rate	2
Balance of Payments	2

Balance of Payments adjustment	2
International reserves	2
Overviews of international financial markets	2
Foreign exchange market & instruments	6
Foreign exchange risk management	2
Eurocurrency market	2

Grading:

Class attendance & performance	5%
Written homework	8.33%
Group presentation	8.33%
Online quizzes & exercise	8.33%
Final exam	70%

Text & Reference Book:

Lianying LI. International Finance [M]. 3/e. Beijing: China Social Sciences Press, 2009.

Reference book:

[1] Yulu Chen. International Finance (fine version) [M]. 5/e. Beijing: China Renmin University Press, 2015.

[3] Boke Jiang. International Finance[M]. 5/e. Fudan University Press, 2012.

[4] M Moffett, A Stonehill, D Eiteman. Fundamentals of Multinational Finance [M]. 5/e. Pearson Education, 2014

[5] C S Eun, B G Resnick. International Financial Management [M]. 7/e. McGraw-Hill, 2014

[6] Jeff Madura. International Financial Management [M]. 12 / e. Cengage Learning, 2014

100210037 International Business Law

Lecture Hours: **32**
Laboratory Hours: **16**
Credits: **3**
Prerequisite(s): **Dynamics**

Course Description:

An intensive introduction to the legal and ethical issues confronting the global business manager. This is an introduction to legal principles and their relationships to business organizations. Representative topics include the legal authority to regulate business, consumer law, employment and labor relations law, torts and crimes related to business, intellectual property, commercial transactions, and contract law. Examines product liability, the administrative legal process of regulation, and the contract as the fundamental legal instrument of global commercial relations. Course content will include applications of these legal principles to domestic and international issues as appropriate.

Course Outcomes:

After completing this course, a student should be able to:
Define legal vocabulary in non-legal terms
Explain key legal concepts and ideas
Demonstrate understanding of contracts and contractual rights and duties
Demonstrate understanding of trade laws and regulation
Identify legal problems in complex factual situations
Apply legal concepts and reasoning to analyze and report on legal problems and cases

Course Content:

Lectures and Lecture Hours:

1. Introduction to International and Comparative Law 2
    - Definition
    - The making of international law
    - International person
    - Comparison of Municipal legal system
2. Dispute Settlement 4
    - Settlement through diplomacy
    - Settlement in international Tribunals
    - Settlement in Municipal courts
    - Choosing the governing law
3. The multinational enterprise 4
    - The business form
    - The multinational organization
    - International regulation
4. Foreign Investment 4
    - Foreign investment laws and codes

- Supervision of foreign investment
- Securities regulations

5. Trade in Goods 4
   - WTO
   - GATT
   - Multinational trade agreement
6. Intellectual Property 6
   - the creation of IPR
   - IPRO
   - Intellectual property treaties
   - The international transfer of intellectual property
   - Licensing regulations
   - Compulsory licenses
7. Sales 6
   - CISG
   - Contractual issues excluded from the coverage of CISG
   - Interpreting CISG
   - Interpreting sales contracts
   - Formation of the contracts
   - General standards of performance
   - Seller's obligations
   - Buyer's obligation
   - The passing of risk
   - Remedies
   - Excuses for nonperformance
8. Review 2
   - Comparison study
   - Dispute settlement
   - Company law
   - IPR
   - Contract law

Grading:

In-class quiz	5%
Homework	10%
Group Presentation	5%
Project	5%
Final	70%
Participation	5%

Text & Reference Book:

August, Ray A., Don Mayer and Michael Bixby, International Business Law: Text, Cases, and Readings, 5th ed., China Machine Press, ISBN: 978-7-111-29687-4.

100210038 Law for Economics

Lecture Hours: **32**
Credits: **2**
Prerequisite(s): **None**

Course Description:

This course is designed to explore the fundamental principles of international economic law and its relations to public international law and private international law. In addition, the course will give a general introduction to the legal systems of those related areas: international trade, international transportation and insurance, international investment, international finance, international taxation, protection of intellectual property rights, international commercial dispute settlement. The instructor will also comment on the current developments of those areas and the research methods concerning them.

Course Outcomes:

After completing the course, students should:

1. Obtain a comprehensive knowledge of the international rules on trade, investment and finance.
2. Have a better understanding of those important international institutions like IMF, World Bank and WTO.
3. Be more familiar with the means to settle the international economic disputes.
4. Be more capable of using English in their study.

Course Content:

Lectures and Lecture Hours:

Principles of EL	2
International Trade Law	4
Market Regulation and WTO Rules	4
International Investment Law	4
International Finance Law	6
International Tax Law	4
Intellectual Property Right Protection	4
International Economic Dispute Settlement	4

Grading:

Homework	30%
Examination	70%

Text & Reference Book:

1. Brownlie, Ian: Principles of Public International Law, fifth edition, Oxford University Press (1998)
2. Brownlie, Ian: Basic Documents in International Law, fourth edition, Oxford University Press (1995)
3 Hilf, Meinhard and Petersmann, Ernst-Ulrich (editors): National Constitutions and International Economic Law, Kluwer Law International (1993)
4. Hudec, Robert E.: The GATT Legal System and W

100210039 Practice of International Trade

Lecture Hours: **32**
Laboratory Hours: **0**
Credits: **2**
Prerequisite(s): **None**

Course Description:

Practice of International Trade offers a comprehensive analysis of the complexities of an international sale transaction through case law, policy documents, legislation, international conventions and rules adopted by international organisations such as the ICC. Focusing on international sales of goods and the various contractual relations that arise as a result of the sale transaction, this course considers and discusses: the formation of a contract, standard trade terms, international transportation of cargo, insurance and payment mechanisms, letters of credit etc. The main and essential issues relating to the conclusion of an international sales of goods and the procedures of fulfilling of the contract.

Course Outcomes:

At the end of the course a student should be able to demonstrate the ability to:
To gain an understanding of the basic requirements for concluding a contract of sales of goods
To understand the nature, characteristics and the division of obligations between the part of Seller and Buyer respectively under all the trade terms embodied in Incoterms 2010 especially FOB and CIF contract.
Understand the types of charter-parties and common law implied obligations in a voyage charter-party.
Understand the nature and functions in international trade of Bill of Lading and implied obligations on the part of both the ship owner and the shipper.
Understand principles of marine insurance law and insurance coverage of ICC and CIC Clauses
Understand the main payment instruments in international trade
Understand how payment is made in international sales of good, especially letter of credit
Understand the nature and characteristics of letter of credit

Course Content:

Lectures and Lecture Hours:

Part 1 international sales of goods

1. Formation of a contract 4
2. Standard trade terms 4
   - International trade practices of trade terms
   - Inco-terms 2010

Part 2 Transportation of cargo

3. Transportation of goods by sea---charter-parties 2
   - Types of charter-parties
   - Common law implied obligations in a voyage charter-parties
   - Common law immunities
   - Usual express terms

4. Bills of lading 2
    - Nature of a bill of lading
    - Rights and liabilities of consignee/endorsee
    - Bills of lading and fraud
5. Bills of lading and common law 2
    - Implied obligations on the part of the shipowner
    - Implied obligations on the part of the shipper
    - Shipowner's immunities
    - Common law exceptions

Part 3 Marine insurance

6. Scope and nature of marine insurance contracts 6
    - Principles of marine insurance law
    - Warranties on the part of the insured-implied and express
    - Deviation
    - Liabilities of insurer
    - ICC (A), (B), and (C)
    - Chinese Insurance Clauses

Part 4 Payment

7. Payment instruments 2
8. Payment methods 4
    - Remittance
    - Collection
    - D/P at sight
    - D/P after sight
    - D/A
    - URC522
9. Letters of Credit 6
    - Nature and advantage
    - Procedures in a documentary credit transaction
    - Characteristics of letters of credit---autonomy and strict compliance
    - Types of letters of credit
    - Waiver and variation
    - The fraud exception

Grading:

Final course grade is calculated as weighted average with the following weights:

Homework	30%
Final Exam	70%

Text & Reference Book:

Indira Carr, International Trade Law, 5th ed, 2013, ISBN: 978-0415659239

Ingeborg Schwenzer, International Sales Law, 2nd ed, 2012, ISBN: 978-1849463027

100210040 Econometrics

Lecture Hours: **32**
Laboratory Hours: **0**
Credits: **2**
Prerequisite(s): 100210025 Macroeconomics; 100210006 Microeconomics; 100171301 Probability and Statistics

Course Description:

Econometrics is the science (and art) of confronting economic models with data for the purposes of testing the models, predicting future events, or generating policy advice. Mathematically, we will be strongly relying on statistics: We will begin by refreshing our knowledge of probability theory, and much talk will be about regression coefficients and hypothesis tests. An important difference to "normal" statistics is the focus on economic data, which are typically not generated by proper experiments. As a result, statistical methods often need to be substantially adapted. Frequently, we will attempt to compensate for problems with data quality by using knowledge (or at least assumptions) from economic theory. This means that to do econometrics well, you need to know your economics and not just your statistics. At the same time, large parts of the course will be useful as statistics for social sciences more generally.

Course Outcomes:

After completing this course, a student should be able to:
Formulate an economic problem.
Build a simple economic model and the corresponding statistical model.
Generate or collect data.
Estimate the model parameters using a statistical software package and a computer.
Perform hypothesis tests, make numerical forecasts, and
Analyze the statistical and economic consequences and the implications of the empirical results.

Course Content:

Lectures and Lecture Hours:

1. The Nature of Econometrics and Economic Data 2
   - What Is Econometrics?
   - Steps in Empirical Economic Analysis
   - Causality and the Notion of Ceteris Paribus in Econometric Analysis
2. The Simple Regression Model 4
   - Definition of the Simple Regression Model
   - Properties of OLS on Any Sample of Data
   - Expected Values and Variances of the OLS Estimators
3. Multiple Regression Analysis: Estimation 4
   - Motivation for Multiple Regression
   - Mechanics and Interpretation of Ordinary Least Squares
   - The Variance of the OLS Estimators
   - Efficiency of OLS: The Gauss-Markov Theorem

4.	Multiple Regression Analysis: Inference	4

- Sampling Distributions of the OLS Estimators
- Testing Hypotheses about a Single Population Parameter: The *t* Test
- Testing Multiple Linear Restrictions: The *F* Test

5. Multiple Regression Analysis: OLS Asymptotics — 2

- Consistency

6. Multiple Regression Analysis with Qualitative Information — 4

- Describing Qualitative Information
- A Single Dummy Independent Variable
- Using Dummy Variables for Multiple Categories
- Interactions Involving Dummy Variables

7. Heteroskedasticity — 4

- Consequences of Heteroskedasticity for OLS
- Heteroskedasticity-Robust Inference after OLS Estimation

8. Heteroskedasticity — 4

- Testing for Heteroskedasticity
- Weighted Least Squares Estimation

9. More on Specification and Data Issues — 4

- Functional Form Misspecification

Grading:

Prerequisite quiz	10%
Homework	10%
Group Presentation	20%
Final	60%

Text & Reference Book:

Wooldridge, J.M., Introductory Econometrics, 5th Edition, South-Western College Publishing, 2013

100210042 Human Resource Management

Lecture Hours: **32**
Credits: **2**
Prerequisite(s): **Management Science; Organizational Behaviour**

Course Description:
This course is a systematic study of human resource management, includes the theory of human resources, human resources management, the emergence and development of human resource management and human resource managers. The course focuses on specific issues of human resource management, such as job analysis, recruitment, training, performance evaluation, salary management, etc. Through the study of this course, the students can understand and master the basic theory and methods of human resource management, and improve their ability to analyze and solve the practical problems of human resource management.

Course Outcomes:
After completing this course, a student should be able to:
Know the status of human resources in the economic and social development.
To master the basic theory of human resources management, basic knowledge and basic methods, such as strategic human resource management, organizational structure and job analysis, human resources planning and recruitment, etc.;
Cultivate the ability to work in the human resource management, such as employee selection, the method of performance management etc.
For further specialized courses and future work.

Course Content:
Lectures and Lecture Hours:
1. Overview of human resource and human resource management 2
   - The basic concept of human resources and its connotation
   - The history of human resource management and its basic connotation
2. Strategic human resource management 4
   - Human resource management and strategy
   - The strategic management of human resource functions
3. The organizational structure and job analysis 4
   - The basic principle of organizational structure and organizational design
   - Summary of job analysis
   - The main method of job analysis and job descriptions
4. Human resources planning and recruitment 4
   - Human resource planning
   - Human resources recruitment
5. Employee selection 4
   - The effect of selection, procedures and standards
   - The main method of selection
6. Training and development 4
   - The basic principles of training and training management

- The main content of training management
- Staff development and professional development

7. Performance management 4

- The basic principle of performance and performance management
- Performance evaluation methods and evaluation form design
- The performance evaluation and feedback

8. Salary and welfare 4

- The general principles of compensation and compensation management
- Position compensation system design
- Performance incentive plan
- Employee benefits

Grading:

Attendance	10%
Homework	50%
Final	40%

Text & Reference Book:

Keyong Dong. Introduction to human resources management, China University Renmin Press,2015.

Xin Liu. Human Resource Management, China Renmin University Press,2015.

100210056 Management Information System

Lecture Hours: **32**
Laboratory Hours: **0**
Credits: **2**
Prerequisite(s): **None**

Course Description:

This course is to help students understand how to appropriately utilize IT tools for the success of a business. Students will learn the major terminology used in the field of MIS and the IT tools for businesses. The course addresses both the strategic and technical parts of MIS, including the strategic and value-chain analysis before employing specific IT tools, different IT tools available for supporting different business strategies, e.g. Supply Chain Management (SCM), Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), database technology, Decision Support Systems (DSS), e-commerce and e-business, etc. Moreover, the topics of systems development and implementation, as well the new trends of Information System at the scenario of Internet+ are also covered.

Course Outcomes:

After completing this course, a student should be able to:

Describe MIS and the important organizational resources within it; describe how to use Porter's Five Forces Model to evaluate the relative attractiveness of an industry; compare and contrast key business strategies; describe the role of value-chain analysis for identifying value-added and -reducing processes.

Define SCM systems, ERP systems, CRM systems, e-collaboration, and describe their strategic and competitive opportunities; discuss the impact IT culture has on technology choices and their implementations within an organization.

Describe the key characteristics of a relational database; define the major software components of a DBMS; describe the key characteristics of a data warehouse; define the major types of data-mining tools.

Define and describe the major e-commerce business models; identify the differences and similarities among customers and their perception of value in B2B and B2C e-commerce; compare and contrast developing a marketing mix in B2B and B2C e-commerce; summarize ways of moving money in e-commerce and related issues; discuss major trends that are impacting both the e-commerce world and society in general.

Define the traditional systems development life cycle (SDLC) and describe the 7 major phases within it; compare and contrast the various component-based development methodologies; describe the selfsourcing process as an alternative to the traditional SDLC; discuss the importance of prototyping and prototyping within any systems development methodology; describe the outsourcing environment and how outsourcing works.

Use the various of Information System at the scenario of Internet+ to resolve the problems that the business may have.

Course Content:

Lectures and Lecture Hours:

1. Introduction 4

- Basic notion of MIS and its key resources
- Porter's management theory
- Porter's five forces model
- Porter's related strategic framework
- Value-chain analysis

2. Major IT tools for supporting different business strategies 8
   - Supply chain management system
   - Customer relationship management
   - E-collaboration
   - Enterprise Resource Planning (ERP)
3. Database and Data Warehouse 6
   - The relational database model
   - Database management system tools
   - Data warehouses and data mining
   - Business intelligence revisited
   - Decision Support and Artificial Intelligence
   - Decision Support system
4. Electronic Commerce 6
   - E-commerce business models
   - Understanding your business, products, services, and customers
   - Marketing portfolio
   - Moving money easily and securely
   - E-Business trends
5. Systems Development 4
   - System development life cycle
   - Component-based development
   - Selfsourcing
   - Prototyping
   - Outsourcing
   - Service-Oriented Architecture
6. New Trend of Information System 4
   - Internet of things, Industry 4.0
   - Social E-commerce
   - Internet Finance

Laboratories and Laboratory Hours:

Grading:

Class Participation	10%
Homework	20%
Final	70%

Text & Reference Book:

S., Haag and M., Cummings, Management information systems for the information age, 8^{th} ed., 2011, ISBN 978-7-111-32282-5.

100210065 Public Finance

Lecture Hours: **32**
Credits: **2**
Prerequisite(s): **Macroeconomics**

Course Description:

This course is to provide basic knowledge of the public finance for undergraduate students who major in economics.

Course Outcomes:

After completing this course, a student should be able to have a basic knowledge of the public finance.

Course Content:

Lectures and Lecture Hours:

Introduction	4
Expenditures of public finance	8
Incomes of public finance	8
Budget	2
Public finance and macroeconomics	4
Public finance and international economy	6

Grading:

Homework	30%
Examination	70%

Text & Reference Book:

陈共，财政学（第八版）， 北京:中国人民大学出版社，2015。
重森曉, 鶴田廣巳, 植田和弘編，Basic 現代財政学，有斐閣，2009。
諸富徹編著，グローバル時代の税制改革，ミネルヴァ書房，2009。
諸富徹著，私たちはなぜ税金を納めるのか：租税の経済思想史，新潮社，2013。

100210073 Cross-Cultural Management

Lecture Hours: **32**
Credits: **2**
Prerequisite(s): International Trade, Management

Course Description:

This course is an elective course for international economics and trade professionals. The main purpose of this course is to set forth the basic theory of culture, basic knowledge and basic methods of international cooperation and international business issues in cross-cultural analysis. Through the course, the students will be cultivated and improve their ability of international operations.

Course Outcomes:

The main task of this course is to learn fundamental knowledge of culture, cross-culture and international cooperation; grasp analysis methods on cross-cultural issues; so as to improve the students' cross-cultural sensitivity, familiarize the students with the management of cultural diversity, intercultural and conflict management strategies and cross-cultural communication skills.

Course Content:

Lectures and Lecture Hours:

1. Introduction 3
   1.1 Globalized business environment
   1.2 Development of cross-cultural management
   1.3 The basic concept of cross-cultural management
   1.4 Cross-cultural management research methods
2. The basic theory of Culture 3
   2.1 The basic concept of culture
   2.2 Schools Cultural Theory
   2.3 Role and significance of culture
3. Comparison and analysis of cultural differences 3
   3.1 Cultural Differences and Transnational Management
   3.2 Comparison of theoretical development of cultural differences
   3.3 Comparison of Cultures in the theoretical model
4. National culture and enterprise culture 4
   4.1 Culture and Business Management
   4.2 The concept of corporate culture
   4.3 The role and significance of corporate culture
   4.4 Type multinational corporate culture
5. International business cooperation in cross-cultural issues analysis 4.
   5.1 Basic forms of international business cooperation
   5.2 Culture and International Strategic Alliances
   5.3 Culture and International Technical Cooperation
   5.4 Cultural and cross-border mergers and acquisitions

6. International Human Resource Management	3
6.1 Transnational Management in human resources issues	
6.2 International recruitment and selection of human resources	
6.3 Intercultural Training & Development	
7. Transnational Management of Cultural Diversity Management	3
7.1 The basic connotation of cultural diversity	
7.2 Cultural Diversity and Transnational Management	
7.3 The basic method of cultural diversity management	
8. Cross-cultural team management	3
8.1 Intercultural Team Types and Characteristics	
8.2 Cross-cultural team group dynamics	
8.3 The basic method of cross-cultural team management	
9. Intercultural Communication Strategy	3
9.1 The basic theory of cross-cultural communication	
9.2 Intercultural Communication Problems	
9.3 Cross-cultural communication skills and strategies	
10. Intercultural Conflict and Negotiation	3
10.1 Intercultural Conflict form and characteristics	
10.2 Cross-cultural conflict management approach	
10.3 Cross-cultural conflict negotiation skills	

Grading:

Project	15%
Group Presentation	15%
Final	70%

Text & Reference Book:

Helen Deresky: International management-Managing across borders and cultures. Text and Cases[M. New Jercey, 6th Ed., 2007

[1]陈晓萍．跨文化管理[M]．北京：清华大学出版社， 2005．

[2]Comfort, Jeremy and P. Franklin: The Mindful International Manager. Competences for working Effectively Across cultures[M]．York: York Associates, 2008

[3]马尔科姆·沃纳，帕特·乔恩特：跨文化管理[M]．北京：机械工业出版社， 2003．

100210075 International Economics

Lecture Hours: **32**
Credits: **2**
Prerequisite(s): **100210006 Microeconomics**

Course Description:

The course introduces the theories of international economics and their application. It seeks to explain the patterns and consequences of transactions and interactions between the inhabitants of different countries, including trade, investment and migration. The aim of this course is to provide students with an understanding of the principles and applications of international economics, so that students will be prepared to face the future complexities of the world economy.

International economics explores the theoretical foundations of International Trade and Finance. The trade section focuses on why nations trade and how free trade can be beneficial or detrimental to trading countries. We will also discuss what governments can do to influence trade flows and how government policy can be used as a strategic tool by a country to achieve its own international objectives; the political debate surrounding such policies are also surveyed. The finance section will focus on balance of payments and market-determined exchange rates.

Course Outcomes:

After completing this course, a student should be able to:

Describe the differences between international and domestic transactions.

Outline the contributions of different schools of international economics to our understanding of trade and its determinants.

Account for the increased importance of new forms and patterns of trade in world economy.

Outline the main measures governments take to regulate trade, explain their effects on national and global economic welfare.

Describe the main types of regional trading agreements, such as free trade areas, customs unions, economic unions and their effects.

Outline and explain the nature of the rules-based system of trade that has existed since the 2nd World War and the role played by multilateral economic institutions, such as the World Trade Organisation (WTO) in the regulation of trade.

Understand the balance of payments of a country and the main items.

Analyze the effects of shifts in the demand and supply curves on market-determined exchange rates.

Course Content:

Lectures and Lecture Hours:

1. World Trade and the National Economy 4
   - Definition
   - What is Unique about International Economics
   - International Transactions-An Empirical Glimpse
   - -Foreign Trade in the National Economy
   - -Forums for Trade and Monetary Issues

2. Why Nations Trade 6
   - The Principle of Comparative Advantage
   - Comparative Opportunity Cost
   - Absolute Advantage and Wage Rates
   - Summary of Policy Implications
   - Dynamic Gains from International Trade
3. The Commodity Composition of Trade 6
   - The Factor proportions Theory
   - Alternative Theories
   - An Emerging Consensus
   - Economic Adjustment to Changing Circumstances
4. Protection of Domestic Industries: The Tariff 6
   - Some Institutional Considerations
   - Economic Effects of the Tariff
   - How protective is the tariff
   - Arguments for Protection
   - Approaches to Free Trade
5. Nontariff Barriers to Trade 4
   - Import Quotas
   - Voluntary Export Restraints
   - International Commodity Agreements
   - International Cartels
   - Local Content Requirement
   - Border Tax Adjustments
   - Dumping
   - Export Subsidies
   - NTBs versus Tariffs
   - Strategic Trade Policy
6. Statement of International Transactions 2
   - Main items in the Statement of International Transaction
   - Uses and Misuses of international Transaction
7. Market-Determined Exchange Rate 4
   - Demand and supply of Foreign Currencies
   - Shifts in the Demand and Supply Curves
   - Exchange-Rate Overshooting
   - The foreign Exchange market

Grading:

Attendance	10%
Homework	10%
Case Analysis	10%
Final	70%

Text & Reference Book:

Mordechai E.Kreinin, Don P.Clark. International Economics: A Policy Approach, 2nd ed., 2015, ISBN 978-7-301-262542

Krugman, P., M. Obstfeld, and M. Melitz. International Economics: Theory and Policy, 9th ed., 2012, ISBN-13: 9780132744836

Robert J. Carbaugh. International Economics, 11th ed., 2010, ISBN 9781439038949

100210078 The World Trade Organisation

Lecture Hours: **32**
Laboratory Hours: **0**
Credits: **2**
Prerequisite(s): **International Economics (trade part)**

Course Description:

The world trading system has undergone massive changes in the last sixteen years. The creation of the WTO and the development of enforceable international rules governing trade in services and intellectual property rights as well as trade in goods vastly expanded the scope and effectiveness of the system. The World Trade Organization (WTO) is the primary organization in the field of economic globalization. WTO law governs the rights of governments to regulate international trade in goods and services and requires them to protect intellectual property. The WTO has an active dispute settlement system which, since 1995, has produced a substantial jurisprudence. The aim of the course is to provide students with a theoretical and practical understanding of the regulatory framework of the world trading system, covering both the institutional and substantive law of the World Trade Organisation (WTO), which has played a central role in promoting and regulating international trade liberalisation since its establishment in April 1994.

Students will explore the key legal disciplines relating to international trade in goods and services, such as the non-discrimination principles, market access commitments and rules on dumping, subsidisation and product standards. Students will then engage with other substantive areas of WTO law, such as the WTO Agreement on Trade in Services, the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights and the principle of special and differential treatment of developing countries. In addition, students will consider how WTO law interacts with other areas of international law and the extent to which WTO members can use trade measures to pursue other (non-trade) values, such as environmental protection, the rights of WTO Members to protect public policy interests. A special theme is the role of developing countries within the WTO system.

Course Outcomes:

At the end of the course a student should be able to demonstrate the ability:

To gain an understanding of the basic structure of the WTO institutions and texts, especially the General Agreement on Tariffs and Trade (GATT).

To examine the institutions, procedures and principles governing the settlement of trade disputes at the WTO.

To examine the remedies available to winners, mechanisms for their enforcement, and barriers to access to justice for developing and new Member States.

To consider the concept of non-discrimination, as expressed in the principles of National Treatment and the Most Favoured Nation Treatment, with special reference to the merits of differential and more favourable treatment of poorer nations.

To explore the protection of the environment both as an objective of, and as a challenge to, the WTO regime.

To explore the treatment of subsidies in the WTO, with special reference to agricultural goods,

such as cotton, that are of economic importance to developed and developing countries.
To examine the nature and scope of the General Agreement on Trade in Services (GATS) with particular reference to its relationship with the GATT and its impact on developing countries.
To explore the nature and implications of efforts to protect intellectual property rights through the WTO, in particular the Agreement on Trade-Related Intellectual Property Rights (TRIPs)

<u>Course Content:</u>

Lectures and Lecture Hours:

1. Introduction 2
   - The World Trade Organisation,
   - The Law of the WTO and
   - WTO dispute settlement
2. Most-favoured-nation treatment 4
   - Most-favoured-nation treatment under the GATT 1994
   - Most-favoured-nation treatment under the GATS
3. National Treatment 4
   - National treatment under the GATT 1994
   - National treatment under the GATS
4. Tariff Barriers 2
   - Customs duties on imports
   - Other duties and charges on imports
   - Customs duties and other duties and charges on exports
5. Non-tariff Barriers 2
   - Quantitative restrictions on trade in goods
   - Other non-tariff barriers on trade in goods
   - Market access barriers to trade in services
   - Other barriers to trade in services
6. General and security exceptions 4
   - General exceptions under the GATT 1994
   - General exceptions under the GATS
   - Security exceptions under the GATT 1994 and the GATS
7. Economic emergency exceptions 2
   - Safeguard measure sunder the GATT 1994 and the Agreement on Safeguards
   - Safeguard measures under other WTO agreements
8. Regional trade exceptions 2
   - Proliferation of regional trade agreements
   - Regional trade exceptions under the GATT 1994
   - Regional trade exceptions under the GATS
9. Dumping 4
   - Basic elements of WTO law on dumping
   - Determination of dumping
   - Determination of injury to the domestic industry

- Demonstration of a causal link
- Anti-dumping investigation
- Anti-dumping measures
- Institutional and procedural provisions of the Anti-dumping Agreement

10. Subsidies 4

- Basic elements of WTO law on subsidies and subsidised trade
- Subsidies covered by the SCM Agreement
- Prohibited subsidies
- Actionable subsidies
- Countervailing measures
- Institutional and procedural provisions
- Special and differential treatment for developing-country Members
- Agricultural subsidies under the Agreement on Agriculture

11. Intellectual property rights 2

- The origins and objectives of the TRIPS Agreement
- Scope of application of the TRIPS Agreement
- General provisions and basic principles of the TRIPS Agreement
- Substantive protection of intellectual property rights

Grading:

Final course grade is calculated as weighted average with the following weights:

Homework	10%
Group Presentation	20%
Final Exam	70%

Text & Reference Book:

Peter Van den Bossche, The Law and Policy of the World Trade Organization (3rd ed 2013)
ISBN-13:978-1107694293
Mitsuo Matsushita, The World Trade Organisation: law, practice and policy (3rd ed 2015)
ISBN-13: 978-0199571857
Mavroidis, Berman, Wu, The Law of the World Trade Organization (2013) (2nd 2013)
ISBN-13: 978-0314287212
Trebilcock and Howse, The Regulation of International Trade (4th ed 2012)
ISBN-13: 978-0415610902

100210079 Business Readings

Lecture Hours: 32
Laboratory Hours: 16
Credits: 2
Prerequisite(s): Microeconomics, Macroeconomics

Course Description:

The purpose of this course is to train students to master the basic skills of reading and understanding business English articles, master some of the common words in international economic articles, understand the general business expression, be familiar with the main types of business English articles, so as to further study the follow-up business English courses,

Course Outcomes:

After completing this course, the students should be able to:
1. Know the expression and style of professional writing in English;
2. Read professional articles and use professional English in international trade;
3. Think and express in English in a professional way, form a professional behavior and awareness;
4. Express their views and ideas in professional English, analyze the problems and industrial trends under a domestic and international economic and trade circumstances

Course Content:

Chapter 1. Basic Knowledge of Business Letter Writing 2
Structure of Business letters
The way of using the Writing parts and their standardized designs
Chapter 2. Business writing and envelope addressing 3
The language characteristics of business writing
The style of business letters and its writing
Chapter 3 Inquiry, Quotation and Counter – offer 3
Inquiry
Quotation
Counter – offer and its declining
Chapter 4. Letter of Credit 3
Advising the Establishment of L/C
Urging the Establishment
Checking the L/C and requesting amendments to L/C
Granting Amendment to L/C
Requesting extension
Chapter 5. Shipment 3
Urging the delivery of the goods
Shipping advice
Booking necessary shipping space in advance
Shipment packing and shipping market
Chapter 6. Invitation 3

Informing the visiting intention	
Sending the invitation letter	
Itineraries and programs	
Invitation card	
Chapter 7 Resume and job – application form	3
Resume and job – application letters	
Hunting for a provisional job	
Hunting for a new job	
Chapter 8 Contract	4
The contents, styles an language characteristics of the contract	
Kinds of standard contracts	
Preparing the English sale contract	
Compensation trade contract	
Exclusive agency agreement	
Chapter 9 Business readings	4
Kinds of scientific readings	
Selection on the business readings	
Key message from newspaper and magazines	
Chapter 10 Scientific readings	4
Organization of scientific paper	
Structure of abstract	
Introduction and methodology	
Analytical results	
Conclusion and discussion	

Grading:

Homework	10%
Group Presentation	10%
Project	10%
Final	60%
Participation	10%

Text & Reference Book:

【1】火树钰. 国际商务英语［M］. 北京：清华大学出版社，2006.
【2】李朝. 大学商贸英语翻译教程［M］. 上海：复旦大学出版社，2007.
【3】罗凤翔，杜清萍. 国际商务英语模拟实训教程［M］. 北京：中国商务出版社，2020.
【4】 廖英. 国际商务英语综合教程［M］. 北京：对外经贸大学出版社，2010.
【5】Leo Jones and Richard Alexander, New International Business English [M]. Cambridge, 2010.
【6】http:// asia.waj.com/home-page.

100210080 Financial Market

Lecture Hours: **32**
Laboratory Hours: **16**
Credits: **2**
Prerequisite(s): **macroeconomics, accounting**

Course Description:
This course is fundamental for banking and some other disciplines, meanwhile it is relatively independent from the modern financial practice courses. The course covers the basic concepts and theories of the financial markets: the basic mode of operational methods; the basic structure and functions of the financial market, the basic law of operation and development; so as to enable the students analyze and practice in the financial market in China.

Course Outcomes:
The purpose of this course is to equip the students with the basic theories and knowledge of financial markets. The students should grasp the operating mechanisms of financial markets and the main financial variables between the interrelated issues, analyze and solve problems, and be able to meet the financial professional training objectives for future studying, theoretical research and practical work. This course insists on the characteristics of the integration of theory and practice, combining with relevant knowledge and ability training, with the characteristics of the students, has important significance for the cultivation of financial professionals.

Course Content:
Lectures and Lecture Hours:
Chapter 1 Introduction to Financial Markets 4
1.1 The concept and subject of financial market
1.2 Types of financial markets
1.3 Functions of financial markets
1.4 Trends in financial markets
Chapter 2 Money Market 4
2.1 Interbank market
2.2 repurchase market
2.3 commercial paper market
2.4 Bank acceptance ticket market
2.5 large amount of negotiable fixed deposit market
2.6 Short - term government bond market
2.7 Money Market Mutual Fund
Chapter 3 Capital Markets 4
3.1 Stock market
3.2 bond market
3.3 Investment Funds
Chapter 4 Foreign Exchange Market 4
4.1 Forex Market Overview
4.2 Composition of foreign exchange market

4.3 Trading methods of foreign exchange market
4.4 Exchange Rate Decision Theory and Influencing Factors
Chapter 5 Bond Market 6
5.1Application of Income Method in Bond Value Analysis
5.2 Principles of bond pricing
5.3 Value of bonds
5.4 duration, convexity and immunity
Chapter 6 Analysis of the Value of Ordinary Shares 6
6.1 Dividend Discount Model
6.2 P / E model
6.3 Free cash flow analysis under indebtedness
6.4The Impact of Inflation on the Evaluation of Stock Value
Chapter 7 Financial Forward, Futures and Exchange 4
7.1 Overview of financial forward and futures
7.2 Forward and futures pricing
7.3 Financial interchange

Grading:

Homework	20%
Final	80%

Text & Reference Book:

教科书：

张亦春等著．金融市场学[M]．北京：高等教育出版社，2013.01

参考书：

罗斯等著. 金融市场学[M]．北京：机械工业出版社，2009.04

100210082 International Business Environment

Lecture Hours: **32**
Credits: **2**
Prerequisite(s): **none**

Course Description:

This introductory course will introduce students to all areas of international business and the environment within which business transactions take place. The challenge is to compete successfully in the global marketplace as it exists today and develops tomorrow. The main topics covered in this course shall provide students with an understanding and appreciation of the following,

Evolution, definitions, patterns, forces, and linkages of international business.
Importance of International Business in the global economy.
Theories of international business, trade, and investment.
Importance of regional economic integration and emerging markets.
Legal, political, economic and cultural environment of global business.
Basic skills of operation, management, and control of global business.
Basic techniques of market research and foreign market entry strategies.
Contemporary issues in global business and their implications.

Course Outcomes:

After completing this course, a student should be able to:
Understand the process of globalization and the implications of globalization for business firms and their managers;
Explain how and why the world's countries differ;
Present a review of the economies and policies of global trade and investment;
Examine the different strategies that businesses can adopt to compete in the global marketplace and enter specific foreign markets;
Explore the role played by marketing, operations, and management within an international business.

Course Content:

Lectures and Lecture Hours:

1. The International Business Imperative 4
   -The need for International Business
   -A definition of International Business
   -New challengers for International Business Managers
2. Trade and Investment Policies 4
   -The global economic crisis and lessons from the depression
   -Rationale and goals of trade and investment policies
   -Changes in the Global Policy Environment
   -Policy Responses to Changing Conditions
   -A Strategic Outlook for Trade and Investment Policies
3. The Theory of Trade and Investment 4

-The Age of Mercantilism
-Classical Trade Theory
-Factor Proportion Trade Theory
-International Investment and Product Cycle Theory
-The Theory of International Investment

4.	Politics and Law -The Home-Country Perspective -Host-Country Political and Legal Environment -Managing the Risk -International Relations and Laws	4
5.	Economic Integration and Emerging Markets -Levels of Economic Integration -Multilateralism and Regionalism -The Domino Theory	4
6.	The Corporation: Ownership, Governance, and Sustainability -Ownership and the Corporate Objective -Corporate Governance -Corporate Responsibility and Sustainability	4
7.	Organization, Implementation, and Control -Organizational Structure -Implementation -Controls	4
8.	New Horizons -Globalization and Friction -The Future of International Business Management -Careers in International Business	4

Grading:

Attendance	10%
Group Project	20%
Case Analysis/Essay	70%

Text & Reference Book:

Michael R. Czinkota,Ikka A. Ronkainen & Michael H. Moffett, International Business_, 8th ed., 2011, ISBN 978-0-470-53065-8.

100210083 World Economy

Lecture Hours: **32**
Credits: **2**
Prerequisite(s): Macroeconomics & Microeconomic

Course Description:

This course is to provide students with understanding of historical evolution as well as the driving forces of the world economy. This course analyzes the major historical economic, political, and social changes in the world economy. The course covers: factors influencing the economic performance, the changes of the form of government, the evolution of technology (including industrialization), and episodes of integration and disintegration of the global economy. In the course, we discuss the existing and potential problems of the world economy, and the students will be led to formulate their own research according to their own interest.

Course Outcomes:

Students who successfully complete the course will be able to
Understand the mechanisms of the economy development;Apply economic theory and analysis to historical and contemporary episodes of economic growth;Read original articles in economic journals;Write well-structured, coherent, and concise essays that synthesize economic ideas, and present their ideas in discussions.

Course Content:

Lectures and Lecture Hours:

Introduction	2
The Contours of World Development	4
The Impact of Western Development on the Rest of the World, 1000－1950	6
The World Economy in the Second Half of the Twentieth Century	6
Contemporary main country and region economy	6
Global economic prospects	4
Issues of hotspot	4

Grading:

Presence	10%
Inclass Quizzes	15%
Group Presentation	20%
Individual Presentation	20%
Final	30%
Instructor Evaluation	5%

Text & Reference Book:

Maddison, Angus. 2001. The World Economy: A Millennial Perspective. Organization for Economic Cooperation and Development Organization for Economic Co-operation and Development (OECD). ISBN: 9264186085
William J. Bernstein. 2010. The Birth of Plenty: How the Prosperity of the Modern World Was Created. McGraw-Hill Professional. ISBN: 0071747044
Randy Charles Epping. A Beginner's Guide to the World Economy. Vintage. ISBN: 0375725792

100210084 Security and Investment

Lecture Hours: 32
Laboratory Hours: 0
Credits: 2
Prerequisite(s): 100210025 Macroeconomics
100210026 Fundamentals of Accounting

Course Description:

Securities and Investment provides students with the skills and guided practice which are necessary to master fundamental concepts in securities and investment. The course introduces the process of investment, contents include: financial markets, financial products, financial products pricing, financial investors' behavior and basic securities and investment techniques, etc. Recent investment theory will be used to analyze the trend of international financial market and the reform in China stock market.

Course Outcomes:

After completing this course, a student should be able to:
1.Gain a deep understanding of theories about the process and outcome of investment.
2.Develop ability to analyze financial products and establish the securities portfolio.
3.Improve financial analysis skills by practicing on cases and simulations.

Course Content:

Lectures and Lecture Hours:

The Nature of Investment; Capital and Capital Market; Stock market in China	3
Stock, Bond and Derivatives and their market	3
China Stock Market and Listing Rules, Trading Rules; Listed company Analysis	3
Net Present Value; Efficient Market	3
Capital Structure Theory; Risky Asset Pricing	3
Stock market Case Workshop	3
Industry Analysis	3
Macro Economy Analysis	3
Financial Report Analysis	3
Investment Techniques and important indexes	3
Stock analysis Case Workshop	3

Grading:

Final individual report	50%
Group project	20%
Case analysis	20%
Individual Participation	10%

Text & Reference Book:

Investments 5h ed, Zvi Bodie, Alex Kane, and Alan J. Marcus, Richard D. Irwin, McGraw-Hill Companies, Inc. 2002.
Investments 6th ed, W. F. Sharpe, G. J. Alexander, and J. V. Bailey, Prentice Hall, Inc., 1999

100210085 International Logistics

Lecture hours: **32**
Credits: **2**
Prerequisite: "International Trade", "International Trade Practice", "International Finance", etc.

I, Goals and Tasks

International Logistics is an emerging discipline, the development trend of economic globalization increasingly rapid international logistics plays an important role in international trade. The essence of international logistics is the principle according to the international division of labor, in accordance with international practice, the use of international logistics network, logistics facilities and logistics technology, goods flow and international exchange in order to promote world optimal allocation of resources and economic development. Students are required to master the basic theory of logistics, based on the basic knowledge and basic skills on having a preliminary settlement of international logistics and distribution network optimization and logistics management program design. Focus on linking theory with practice, focusing on international logistics practices, aimed at improving students' independent thinking, problem solving, creative thinking ability and specific skills.

II，Teaching Content and Hours allocation

Chapter 1 Overview of International Logistics (4 hours)
1.1 Introduction
1.2 Meaning and International Logistics Development
1.3 In The Form of International Logistics, and Association with Domestic Logistics Links and Differences
1.4 Development of International Logistics
1.5 Development of International Logistics
1.6 The contents of Logistics
1.7 Summary
[Review Questions]
【Case Analysis】
Chapter 2 International Logistics System and International Logistics Network (4 hours)
2.1 Introduction
2.2Composition and Mode Of Operation of International Logistics System
2.3 International Logistics Nodes
2.4 International Logistics Nodes: Port
2.5 International Logistics Nodes: Port
2.6 International Logistics Nodes: Free Trade Zone, The Bonded Area and Export Processing Zones
2.7 International Logistics Node: International Logistics Center, International Logistics Park
2.8International Logistics Connection
2.9 International Logistics Network
2.10 Summary
[Review Questions]
【Case Analysis】

Chapter 3 International Logistics Related to International Trade (4 hours)
3.1 Introduction
3.2 The International Logistics and International Trade
3.3 International Logistics Enterprises to Fulfill The Business in Import and Export Contracts
3.4 Summary
[Review Questions]
【CASE ANALYSIS】
Chapter 4 International Logistics Operations (a) (4 hours)
4.1 Introduction
4.2 International Commodity and Material Procurement
4.3 International Trade and Goods Packaging
4.4 International Cargo Warehousing and Storage
4.5 International Trade Processing
4.6 Handling International Cargo
4.7 Summary
[Review Questions]
【Case Analysis】
Chapter 5 International Logistics Operations (b) (4 hours)
5.1 Introduction
5.2 Inspection and Quarantine Role in International Logistics
5.3 International Logistics Agency Inspection Companies
5.4 Entry-Exit Inspection of Goods Traffic
5.5 Entry and Exit Inspection and Quarantine Means of Transport
5.6 Customs Control of International Logistics
5.7 International Logistics Enterprises Acting General Cargo Import and Export Declarations
5.8 Summary
[Review Questions]
【Case Analysis】
Chapter 6 International Logistics Operations (c) (4 hours)
6.1 Introduction
6.2 International Logistics and Transport Characteristics, Composition, Methods and Security
6.3 International Maritime, Air and Rail Transport Logistics
6.4 International Container and Multimodal Transport and Other Modes of Transportation Logistics
6.5 International Logistics and Transport Insurance Business Links
6.6 Sea, Land, Air and Postal Transport Insurance
6.7 Summary
[Review Questions]
【Case Analysis】
Chapter 7 International Logistics Services (4 Hours)
7.1 Introduction
7.2 Overview of International Logistics Services
7.3 Shipping Agency
7.4 International Freight Forwarders
7.5 International Third Party Logistics
7.6 Determine The Level Of Customer Service and Improvement

7.7 Summary

[Review Questions]

【Case Analysis】

Chapter 8 International Logistics Management (4 Hours)

8.1 Introduction

8.2 Content and International Logistics Management Steps

8.3International Logistics Plans To Develop

8.4 International Logistics Cost Control

8.5International Logistics Performance Evaluation

8.6 Logistics Information and Communication Technology and Intelligent Management

8.7 International Logistics Supply Chain Management

8.8 Summary

[Review Questions]

【Case Analysis】

III，Evaluation and Grading

Assessment: Final exam and usually results using integrated assessment methods.

Grading: usual job performance 30% Final examination 70%, the implementation of weighted percentile.

IV，Outline Description

1. This outline is based on the Ministry of Education Teaching Teaching steering committee to develop the basic requirements and with due consideration of our teaching demands for reform have been made.
2. Premising to ensure the basic teaching requirements, teachers can based on the actual situation, the content appropriate adjustments and deletions.
3. The syllabus for International Economy and Trade Specialty.

V，Textbooks, References

[1] Zhang Liangwei. International logistics [M] Beijing: Higher Education Press, 2011

[2] Lu Yuduo International Logistics (21 century economics textbook quality characteristics) [M] Beijing: Tsinghua University Press, 2012.

[3] Liu Wenge, Liu Liyan. International logistics and freight forwarders [M] Beijing: Tsinghua University Press, 2012.

[4] Wang Shihui. International logistics management [M]. Tianjin: Tianjin University Press, 2012.

[5] Chen Zhigang International Logistics Practice [M]. Beijing: Electronic Industry Press, 2012.

[6] Wang Renxiang. International Logistics [M]. Hangzhou: Zhejiang University Press, 2013.

[7] Rao Kunluo. International logistics practice [M] Wuhan: Wuhan University of Technology Press,2013.

[8] Wang Zhaofeng. International Logistics Management [M] Beijing: Electronic Industry Press, 2013.

[9] Liu Aie Logistics Practice [M] Beijing: People's Posts and Telecommunications Press,2013.

[10] Zhang Haiyan, Lv Mingzhe. International logistics [M] Dalian: Dongbei University of Finance and Economics Press, 2014.

[11] (US) David, PA. International Logistics: international trade operations management: 4th Edition (International logistics-the management of international trade operations, 4th ed.) [M] Beijing: Tsinghua University Press, 2014.

100210086 Modern Advertising

Lecture Hours: **32**
Laboratory/Discussion Hours included: **4**
Credits: **2**
Term (If necessary): The 6th of program
Prerequisite(s): Marketing Principles

Course Description:

This course is to explore one of the obvious marketing functions and its applications in advertising practice in the real world of business development in this age of globalization. Students are designed to know how modern advertising should be understood, and how in practice such activities of marketing management has to be operated well with the other functions in integrated marketing communications for special business to grow in a long-run sustainable way. Advertising theories, concepts, framework, models and methods will be introduced, discussed and analyzed. Learners are required to participate in in-class discussions, individual presentations and team work projects during the whole process of the course.

Course Outcomes:

After completing this course, a student should be able to:

Develop their professional comprehension of the advertising theories, concepts, framework, models, methods and their suitable applications in business conduct in this era of globalization;

Analyze particular issues in advertisement of companies in the real competitive business world;

Design appropriate plans and schemes for developing companies' advertising business in a special market of a competitive environment;

Use proper theories, concepts, models and methods in applications of a brand's advertising business to develop in a given market and competitive circumstance.

Course Content:

Lectures and Lecture Hours (in-class discussion included):

Introduction - Sales of Commodity and Service Need Advertising	4
Environment of Advertising	4
Strategy for Integrated Marketing Communications	4
Understanding Insights of Consumer Behaviors	4
Research into Advertising Strategy and Evaluation	4
Creativeness of Media Strategy	4
Integration of Communication Tools in Advertising Operation	4
Creativeness of Advertising and Its Actualization	4

Grading System:

Homework	20%
Group Presentation	20%
Final Exam	40%

Main Textbook & Reference Books:

1. Bruce Bergh and Helen Katz (2006), Advertising Principles：Choice，Challenge and Change, World Knowledge Press, Beijing.

2. Yan Boqin，Successful 80 Cases of Advertisements，China Friendship Press Corporation，Beijing.

100210087 International Trade Documents

Lecture Hours: **16**
Laboratory Hours: **4**
Credits: **1**
Prerequisite(s): **none**

Course Description:

This course introduces the basic types of international trade documents and their application, and develops students' capability to manage and conduct documents in practice. The course explores concepts, theories and practice of International Trade Documents, which focuses on types, roles, procedure and practice of international trade documents. Students are expected to understand the concept, theory and international practice in international trade documentation practice, and to making flexible use in various scenarios.

Course Outcomes:

After completing this course, a student should be able to:
Understand basic types of international business documents.
Outline the procedure and practice in international trade documents.
Deal with and process international trade documents in given scenarios.
Resolve problem in international trade documents practice.

Course Content:

Lectures and Lecture Hours:

1. International Trade Procedure 2
   -basic procedure
   -contract execution
   -different terms of payment
   -UCP600
2. Types of International Trade Documents 4
   -roles and procedure
   -contracts
   -settlement documents
   -Custom's documents
   -administrative documents
   -others
3. Letter of Credit 6 (4 laboratory hours included)
   -L/C settlement procedure
   -L/C documents
   -L/C documents experiment
4. Practical problems in international trade documents 2
   -documents and negotiation
   -time management
   -terms of payment
5. E-documents in international trade 2

- historical development
-features and application
-future of e-documents

Laboratories and Laboratory Hours:	4
1. L/C opening experiment	1
2. L/C documents conduction experiment	3

Grading:

Attendance	10%
Experimental report	20%
Coursework	70%

Text & Reference Book:

[1]李京. 国际贸易单证 [M]. 北京: 北京理工大学出版社，2008
[2]苏宗祥，徐捷. 国际结算（第六版）[M]. 北京：中国金融出版社，2015
[3]SWIFT UCP 600 Usage Guidelines, Society for Worldwide Interbank Financial Telecommunication, 2007.
International Standard Banking Practice for the Examination of Documents under Documentary Credits subject to UCP 600 (ISBP)．International Chamber of Commerce, 2006.
Lockwood, Henry. Documents necessary for smooth sailing of export goods[J]. Caribbean Business, 9/26/96, Vol. 24 Issue 38: 7
[4]ICC 跟单信用证统一惯例（2007 年修订本）[M]．北京：中国民主法制出版社，2006
[5][美]爱德华・G・辛克尔曼 ．国际贸易单证—进出口、运输和银行单证[M]. 北京：经济科学出版社，2003

100210088 Business Simulation

Lecture Hours: **26**
Laboratory Hours: **6**
Credits: **2**
Prerequisite(s): Management， Accounting，Strategic management，Marketing

Course Description:

This course is designed to immerse you in the challenges faced by the managers venturing in the markets. We will explore the key activities undertaken by the managers: evaluate new market opportunities, develop market entry strategies and effectively manage expansion in international markets. We will consider the essential strategic, organizational challenges and managerial issues encountered by international managers, associated with different modes of entry.

An important component of this course is: the students will work in teams to devise a global expansion strategy, and then execute this strategy through a computer-based simulation game called CESIM Global Challenge. Through simulation exercises, a team will plan and implement its firm's value chain activities across three regions as international expansion, while the other teams are attempting to compete in those same markets.

Course Outcomes:

After completing this course, a student should be able to:
Understanding and analysis the complex business environments
Devising a global expansion strategy for the company and then to execute this strategy
Use management knowledge to solve business problem.
Learn teamwork abilities and to communicate with others effectively

Course Content:

Lectures and Lecture Hours:

1. Introduction to course 2
    - Introduction to simulation
    - Introduction to CESIM GC Case and Simulation
2. Teamwork and communication 4
    - Teamwork
    - Communication skills
3. Global Expansion Strategy Plan 4
    - The principle of strategy
    - Strategy process
    - Strategy making
4. Marketing decision 4
    - Understanding the environments
    - Segmenting and Targeting markets
    - Marketing strategy
5. competition 2
    - Industry and competitor analysis

- Completion strategy

6.	Global Manufacturing and operation decision	3

- Operation management
- Cost control

7.	Investment and financing	3

- Investment
- Financing

8.	Final Report	4

Laboratories and Laboratory Hours:	6
1. Simulating practice round	2
2 . Simulating round four	2
3 .Simulating round ten	2

Grading:

Class Participation	10%
Expansion Strategy Report	10%
Group Presentation	10%
Simulation performance	40%
Final coursework	30%

Text & Reference Book:

Cesim Global Challenge Case Description

Cesim Global Challenge Decision-making Guide

100210097 International Marketing

Lecture Hours: **32**
Laboratory Hours: **0**
Credits: **2**
Prerequisite(s): **Economics, International Trade, Marketing**

Course Description:

This course is designed to help the student to develop the basic skills required to make optimal marketing decisions in an international setting. Topics include the environment of international marketing, market research, product and brand management, pricing strategies, logistics and supply chain management, promotional strategies.

Course Outcomes:

After completing this course, a student should be able to:
Understand the principles of international marketing.
Analyze international marketing practice.

Course Content:

Lectures and Lecture Hours:

1. Introduction 2
- An overview
- Concept & theories of marketing
- History and Development of International marketing

2. Environment of Internatinal Marketing 6
- The Cultural Environment
- The Economic Environment
- The Legal Environment
- The Political Environment

3. International Marketing Opportunities & Strategies 2
- Marketing Research and Information System
- Consumer Markets & Consumer Buyer Behavior
- Market Segmentation, Targeting & Positioning

4. Market Entry Mode 6
- Export
- Contractual
- Direct Investment
- Cases

5. Products Strategies 4
- Product Decisions
- International Product Policy –Standardization or Modification
- International Product Life Cycle Strategy

6. Pricing Strategies 4
- The factors influencing priding

- Pricing Strategy
- Product Adjustment Strategy

7. Promotion Strategies 2

- Advertising
- Sales Promotion
- Public Relations
- Direct Marketing

8. Distribution Strategies 2

- Nature of Distribution Channels
- Channel Design Decisions
- Channel Management Decisions

9. Case: 4

Grading:

Homework	15%
Inclass Quizzes	15%
Group Presentation	10%
Final Exam	60%

Text & Reference Book:

Text:

Wang Xiaodong. International Marketing. Beijing. China Renmin University Press. 201501

Reference Book:

Michael R. Czinkota, Iikka A. Ronkainen .International Marketing. Beijing. China Renmin University Press. 201504

Journals, magazines, newspapers and sources on International Management & Marketing

100210146 Research Methodology in Applied Economics

Lecture Hours: **16**
Credits: **1**
Prerequisite(s): Microeconomics, Macroeconomics, Econometrics

Course Description:

This course is based on a brief presentation on applied economics research methodology. Through its operational analysis training, the students have the ability to issue a preliminary empirical analysis, subsequent to the completion of dissertation writing.

Course Outcomes:

Through lectures and discussions, students should grasp basic economics methods and application, as well as the latest developments of domestic and foreign developments in this field.

Course Content:

Lectures and Lecture Hours:

Chapter 1 Basic Theory of Research Methodology
Chapter 2 Research Areas of Applied Economics
Chapter 3 Applied Economics in Methodological Issues
Chapter 4 Common Theory and Model

Grading:

Project	50%
Group Presentation	25%
Class attendance	25%

Text & Reference Book:

Don Ethridge, Research Methodology in Applied Economics, Economic science press, 2007

100210147 Advanced Topics on Applied Economics

Lecture Hours: **16**
Laboratory Hours: **0**
Credits: **1**
Prerequisite(s): **Economics, International Trade**

Course Description:
This course is to explore the advanced topics in applied economics to senior students majoring in international economics and trade.

Course Outcomes:
After completing this course, a student should be able to:
Understand the new developments in the study of applied economics
Analyze the current situation of international trade and global values

Course Content:
Lectures and Lecture Hours:
1. Advanced topics of international trade theory
2. Advanced topics of international trade policy
3. Advanced topics of international finance
4. Advanced topics of international trade an climate change

Grading:

Homework	30%
Final	70%

Text & Reference Book:
This course has no texts. The instructor will give out reading materials as needed.

100210183 Study Project

Lecture Hours: **36**
Credits: **2**

Course Description:

Study project is an in-depth practice after the completion of the curriculum. It is an important link for students to achieve the goal of learning international trade. It is also an important part of the comprehensive study. Through the combination of theory and practice, the project further improve the students' abilities to observe the practical problem and apply appropriate method to analyze and solve the problem.

Course Outcomes:

Through the international economic and trade-related issues of social survey, the comprehensive use of the professional knowledge of the understanding of the problem to improve students in the international economic and trade development status, trends and issues of understanding, improve student application theory Knowledge of the ability to investigate and analyze real problems in the international economy and trade, and to lay a solid foundation for further learning of professional knowledge.

Course Content:

Lectures and Lecture Hours:

1) To understand and analyze the status and role of foreign trade and economic cooperation in the national economy;
2) To understand and analyze the development of domestic and international economic situation and the opportunities and challenges facing foreign economic and trade development;
3) To understand and analyze the status quo of China's foreign trade enterprises, foreign trade enterprises experience and problems;
4) To understand and analyze China's use of foreign capital and overseas investment in the business situation;
5) Do research with the instructor.

Grading:

Five grades: excellent, good, medium, pass and fail,

100210207 Internship

Lecture Hours: **96**
Laboratory Hours: **0**
Credits: **6**
Prerequisite(s): A: Essentials of Accounting, Financial Accounting I & II; Cost Accounting, Managerial Accounting; B: Financial Management; Advanced Accounting; Auditing; C: Management Information Systems; Valuation; Financial Analysis （A:Compulsory Courses with Final Exams; B:Compulsory Courses; C:Prerequisite Recommended）

Course Description:

This course is to apply accounting theories in practice thus to enhance students' ability of analyzing and solving actual problems. By practicing accounting skills such as recording, managing corporate finance and auditing in the real world, the students will get further understanding of accounting and financial works. This course will help to connect the knowledge learned from school with the real world, and thus set a grounded basis for working after graduation. At the meanwhile, students could also collect resources necessary for their research during their internship.

Course Outcomes:

After completing this course, a student should be able to:

Acknowledge the nature of accounting, accounting ethics, standard accounting procedure as well as his/ her own outlook,

Master the basic knowledge and skills of accounting, financial management, auditing, and the use of basic software,

Collect and evaluate important research papers and resources in accounting and financial management independently,

Understand standard accounting procedure and policy, involve in corporate's inner-control or financial work.

Make financial decisions and solve financial problems,

Develop the professional way of thinking and the ability to communicate with or lead a team.

Course Content:

Lectures and Lecture Hours:

1. Introducing knowledge 4
   - Understand the overall version of corporate financial management and financial accounting
   - Get used to basic accounting procedures
2. Corporate accounting practice 3
   - Learn the organization of accounting practice
   - Work independently with a instructor
3. Comprehensive Budgeting 6
   - Learn to make a comprehensive budget
   - Know the importance of Comprehensive Budgeting

4. Accounting Document 6
    - Get to know different kinds of accounting documents
    - Learn to fill up and deliver accounting documents.
5. Assets and management 8
    - Understand the accounting of financial assets, inventory, fixed assets, and intangible assets
    - Learn to manage financial assets, inventory, fixed assets, and intangible assets
6. Costs 3
    - Learn to manage cost and
    - Learn the accounting of cost
7. Financial policy 4
    - Get familiar with the accounting policies of a company
    - Understand their impact on the financial situation and operation.
8. Cash Administration 4
    - Learn capital organization in companies
    - Understand the internal accounting system and
    - The situation of internal bank of a company
9. Financial Analysis 4
    - Learn how to make financial decisions and
    - Financial analysis and prediction
10. Internal Auditing 6
    - Learn the structure of internal audit institutions, staffing and division of duties
    - evaluate enterprise internal control system
11. Auditing practice
    - Understand the folk audit services and
    - Master skills in a specific folk audit service

Grading:

Prerequisite quiz	3%
Homework	10%
Inclass Quizzes	5%
Group Presentation	5%
2 Midterm Exams	40%
Project	15%
Final	17%
Instructor Evaluation	5%

Text & Reference Book: N/A

100210213 Graduation Project (Thesis)

Lecture Hours: **0**
Laboratory Hours: **384**
Credits: **12**
Prerequisite(s): **None**

Course Description:

This course is a key process of university education. It reflects a student's overall ability. By writing thesis, a student should master the ability to analyze a problem by using related theories and methods, the ability to resolve problems using proper methods, the ability to search and review literature and materials, and the ability of written and oral presentation.

Course Outcomes:

After completing this course, a student should be able to:
Develop a strong writing ability, and utilize related knowledge to write their thesis. The thesis should have rich content, proper structure, strong logic and standard format.
Master the basic interpersonal communication skills, effectively communicate with their superior, give oral presentation and answer questions.
Design a proper method to resolve the problem after they systematically analyze the problem.
Use modern information technology to search for literature, materials and information, systematically analyze and review the searched materials.

Course Content:

Students write their thesis under the guidance of their supervisors, and the progress should meet the school and the university's requirement.

Grading:

Mid-term inspection	10%
Thesis review	10%
Supervisor evaluation	30%
Thesis defense	50%

Text & Reference Book:

The supervisor is responsible for providing the literature based on the research topic.

100210219 Humanities

Lecture Hours: **16**
Credits: **1**
Prerequisite(s): **Microeconomics, Macroeconomics, International Trade**

Course Description:
Through the social survey related to the international trade professional, the students should have an overview of the profession in both domestic and international circumstances, understand the needs for the training and be familiar with the business requirements and the work content in trade.

Course Outcomes:
The course is a professional investigation to stimulate students' enthusiasm for learning, set up a clear learning objective and is significant to guide the students to establish as early as possible the direction of their career. The course provides as well practical experience for the students for their further study in the school.

Course Content:
1.Foreign business processes
2.the domestic and foreign institutions of other countries, set up professional requirements

Grading:
Five grades: excellent, good, medium, pass and fail

General Basic Courses

Course Descriptions

100051294 Electronic Practice (Radio Installation)

This course is a comprehensive practice course. Through the 6 tube heterodyne transistor radio production and debugging, it can cultivate student's comprehensive hands-on practical ability. The content and topic of this course are designed explicitly to meet the needs of the non-majors and are relevant to their major area of study.

Prerequisite(s): Physics A II

100062203 Digital Fundamentals Lab

The course is the laboratory supplement to "Analog Fundamentals". Basic analog circuits and theory of operation amplifiers are covered in the course. It consists of experiments on amplifier, feedback amplifier, operational amplifier application, voltage regulator application, voltage controlled oscillator.

Prerequisite(s): Physics, Circuit Analysis

100070008 Database Technology and Application

This course is to explore how to use Access Database, VBA and SQL to create Database application system. The course is a basic course for computer applications, suitable for undergraduates of all majors. Through the study of this course, the students should be familiar with database design and operation, including the design and use of the database table, query, form, PivotTable / maps, reports, data access pages, macros and modules, and access support for Internet, database security management, etc. so as to achieve the ability to develop simple database application system, and lay the foundation for future study and application development.

Prerequisite(s): Computer Basics

100070015 Multimedia Technology

This course is an elective course for upper-level undergraduates major in Computer Science and Technology. It aims to equip the students with fundamental multimedia technology which is required in multimedia research and application development. The course covers the theoretical and practical aspects of multimedia technologies, including multimedia data compression, multimedia computer systems and software development environment, multimedia content management, multimedia communications, new technologies and applications in multimedia, etc.

Prerequisite(s): Computer Science Introduction, Operating Systems, Computer Networks

100160501 Principle of Life Science A

This course introduces the basic knowledge in life science, which includes: the basic concepts of modern biology, the principle, the method and the important branches, focus will be put on the interdiscipline of life science, as well as its application in different fields. Human health, nutrition, sanitation are important in everyday life. The lack of knowledge in these areas will generate rumors and pseudo science. The course will construct the knowledge system, build a comprehensive scientific literacy for the students as the citizens in the new era.

100160502 Principle of Life Science B

This course summarizes the basic knowledge in life science, which includes the basic concepts of modern biology, the principle, the method and the important branches. Focus will be put on the interdiscipline of life science, as well as its application in different fields. Human health, nutrition, sanitation are important in everyday life. The lack of knowledge will generate rumors and pseudo science. The course will construct the knowledge system, build a comprehensive scientific literacy for the students as the citizens in the new era.

100171301 Probability Theory and Mathematical Statistics

This course is to explore the mathematical modeling of random problems. Beyond the classical probability calculation, we will give a modern strict foundation of stochastic problems according to Kolmogorov. Stemming from the typical Binomial, Poisson, Normal random variables, we will establish the general notion of random variable and its distribution. Then we can explore the proofs and the applications of the crucial limit theories including large number theory and central limit theory.

Prerequisite(s): Mathematical Analysis

100172001 Complex Variables and Integral Transforms

The course introduces the complex variable theory and its applications involving Fourier Transform and Laplace Transform.

Prerequisite(s): Advanced Calculus,Linear Algebra

100172002 Linear Algebra B

This course is required for the students major in engineering, management, etc. Its purpose is to provide an introduction to linear algebra, a branch of mathematics dealing with matrices and vector spaces. Its fundament concepts, theories and methods are the foundation of many modern science theories and engineering technologies, such as differential equation, matrix analysis, physics, control theory, information science, chemistry, biology, economics, business, and so on.

100172003 Probability Theory and Mathematical Statistics

This course is a public basic course for undergraduate students, and it is a mathematical course to study the random phenomena. This course provides an elementary introduction to probability and statistics with applications. Topics include: basic probability models, random variables, discrete and continuous probability distributions, law of large numbers, central limit theorem, statistical estimation and testing. Probability and mathematical statistics have a very wide range of applications. In this course, we will give some introduction about the basic concepts, theories and methods in probability theory and mathematical statistics. The purpose of this course is to familiarize students with main methods of probability and statistics to deal with practical problems and even to lay some foundation for the forthcoming study.

Prerequisite(s): Calculus

100172101,100172102 Calculus A

Calculus A is a two-semester compulsory course for the undergraduates major in the general engineering (except Electronics and Communications Engineering, Computer Application Technology etc.). Through the studying of this course, students will master basic concepts, basic theory and basic computing skills of calculus. The course can cultivate students' ability of understanding mathematical language, abstracting general problem, logical reasoning, spatial imagination and skilled computing. In addition, the course can cultivate students the ability to analyze and solve practical problem and lay fundamentals to study the follow-up courses.

100172103/203 Mathematical Analysis for Engineering

This course introduces the basic concepts, basic theories and basic methods of calculus, so as to foster the students' capabilities of theoretical analysis, mathematical arguments, and skilled mathematics calculation. After completing this course, the students will be equipped with certain abilities of abstract thinking, logical reasoning, and spatial imagination, and most importantly, putting what they learn into practice. This course also lays the foundations for future study of subsequent courses.

100172205 Partial Differential Equations of Mathematical Physics and Special Functions

This course is to explore the problem of determining solutions to partial differential equations of mathematical physics. Primarily, three kinds of typical partial differential equations are introduced. Then we focus on several methods to solve problem of determining solutions to partial differential equations of mathematical physics such as method of traveling wave, method of separating variables, method of integral transform and method of Green's function. Finally, two special functions, Bessel function and Legendre polynomial, and their applications are presented.

Prerequisite(s): Calculus, Complex function and integral transform

100180116/125 Physics Laboratory B I, II

This course is to learn the common measured data processing methods with the knowledge of uncertainty theory; master the common methods and operation techniques in physics laboratory, and the measure methods of basic physical parameters; know about the principles and applications of modern physics technologies and instruments which are widely used in current scientific research and engineering; understand the physical idea and experimental design in some classical physics laboratories.

Prerequisite(s): College Physics A Ⅰ, II

101190003 General Chemistry C

General Chemistry C is a basic course for students of non-chemical and chemical engineer majors. It aims to make the students know the universality and importance of chemical change, which can improve their knowledge and ability structure. It is essential for the development of a knowledgeable, competent, and highly qualified engineering science and technology talent.

Prerequisite(s): high school chemistry

100210045 Document Retrieval

Document Retrieval is a common basic course, teaching the methodology of obtaining knowledge from literature resources with retrieval tools. The basic task of the course is to equip the students with fundamental theory and knowledge of document retrieval, familiarize the students with the knowledge and usage of various retrieval tools and computer retrieval systems. It aims to help the students understand the operation of modern libraries, how data is collated, how to use the data and resources, what information and service a library can provide; help the students to grasp the characteristics of network information, and grasp the skills to obtain information from networks.

100230057 Introduction to Intellectual Property Law

This course provides the students not major in law the basic concepts, theories and systems of the copyright, patent, trademark and other intellectual property. The course forms a more reasonable knowledge structure and develops a strong awareness of intellectual property to the students. It equips the students with abilities to analyze and solve intellectual property problems, to protect their intellectual property rights and respect the intellectual property rights of others in their future study, work and life.

100245101/102 College English

The syllabus is formulated on the "Guide to College English Teaching (Exposure Draft)" in 2015, issued by the Steering Committee of College Foreign Language Teaching in Colleges and Universities of Ministry of Education, and due consideration is given to the requirements of college English teaching reforms and development of our University. On the premise of ensuring the basic teaching requirements, the Undergraduate College English Education Unit can make appropriate adjustments to accommodating the actual situation. Teachers are allowed to add up and delete the contents in order to improve teaching efficiency and keep consistent with the teaching purposes and tasks of the whole school year in regular classes. The syllabus will be practiced by all non-English major regular classes in BIT except for ESP students, Art students, Physical students and minority students. The main language of instructions of the course is English.

100320001-100320004 Physical Education I~IV
Physical Education (PE) is one of the most important compulsory courses in college education. It is also an important standard to evaluate the quality of college education. The aim of PE is to enhance body quality and improve students' health and strengthen PE self-cultivation by reasonable physical and health education, and scientific physical training process. PE is an important component in the undergraduate curriculum system. PE incorporates body development, moral and ideological education, science and culture education, life and labor skill education, mind cultivation into various physical activities.

101014003 Engineering Mechanics B
Engineering Mechanics B is a fundamental course for non-mechanical specialties. This course is intended to provide students with a clear and thorough picture of both the theory and application of the principles in theoretical mechanics and mechanics of materials. Theoretical mechanics includes three parts: statics, kinematics and kinetics. The first part - statics, introduces basic concepts and principles of statics, free-body diagrams, resultants and equilibrium of force system, etc. The second part - kinematics, covers kinematics of a point, translation and rotation of rigid bodies, composite motion of a point, and plane motion of rigid bodies. The third part - kinetics, introduces fundamental laws of kinematics and differential equations of a particle, the principle of impulse and momentum, the principle of work and kinetic energy, and D'Alembert's principle. Mechanics of materials deals with concepts of stress and train, mechanical properties of materials, the state of stress and strain for tension, compression, shear, torsion and bending, etc.

101031102 Engineering Graphics Fundamental
This course provides fundamental skills of the reading and writing, and the international and national standards on engineering drawing. The course focuses on presentation of 3-dimensional geometry on 2-dimensional media and the reading and writing of the working drawing.

101031314 Basic Training of Manufacturing Technology
This course is to explore mechanical manufacturing technique through lectures and basic trainings. Most of the modern manufacturing methods and typical machine tools will be introduced and used during the course. Basic equipment operating skills will be trained.

101037302 Engineering Graphics
This course provides fundamental skills of engineering drawing reading and writing, international and national standards on engineering drawing. The course focuses on presentation of 3-dimensional geometry on 2-dimensional media and working drawing reading and writing. This course also provides fundamental skill of parametric design and working drawing representation with modelling software. The main purpose of this course is not modelling skill and the main focus is new design concept and representation technique including rendering and formal working drawing made with modelling software.

101037303 Research Methods and Academic Writing
This course is to improve the students' ability in conducting research and academic writing, with emphases on research methodology, English usage in academic writing, conventions in mechanical engineering. The general research methods are introduced, as long as the reports needed in scientific and engineering research. Some typical sentence patterns will be introduced to enhance the quality of academic writing. Finally, the method of writing a technical article for publication in a technical journal will be introduced. Numerous samples of academic writing will be used and the students will be asked to practice extensively to fully use the methods that they have learned.

101037305 Principle and Application of Engineering Materials

This course provides comprehensive knowledge and insight into the properties, structure and behaviour of engineering materials. The main materials discussed in this course are metal (ferrous and non-ferrous alloy), ceramics, polymers and composite. These special material structures and properties are studied in detail so that we can understand that how structure dictates properties and how processing can change structure. Furthermore, how to select the right material from the thousands that are available is discussed based on some criteria.

Prerequisite(s): 101180111, 101180121, 101190003

101037308 Machine Design Project

This is an advanced course on modelling, design, and integration of simple mechanical system. It also serves as a best practice for students to learn the way in which machine elements such as bearings, gears, shaft, bolts, cams and mechanisms are used. Modelling and analysis of these elements is based upon extensive application of core mechanical engineering principles. These principles are reinforced through a substantial design project wherein students model, design, fabricate and characterize a mechanical system that is relevant to a real-world application. The main goal of this course project is to practice the knowledge from the prerequisites mainly including the courses such as machine design etc., and to help students to successfully tackle genuine engineering problems encountered in practice.

Prerequisite(s): 101037307

101037326/101050204/101062101 Introduction to Engineering

This is an introductory course for engineering students to understand the fundamentals of engineering. The whole instruction activity is organized to help engineering students in:

1. forming a global engineering mind-set, so that they understand the engineering process and to best practice on solving engineering problems and designing products, no matter what industries they are in;
2. gaining hands-on experiences by directly working with international senior engineers, so that they learn from the real world to solve meaningful problems and design meaningful products.

The course is a team-taught course with the following primary objectives:

1. To foster engineering mindset for engineering students as a basic skill to solve engineering problems;
2. To introduce students to basic engineering design concept, principle, methodology, best practice, and engineering process;
3. To assist students in acquiring skills for identifying, formulating, and solving real world engineering problems;
4. To equip students with the knowledge of engineering sustainability and the mindset of sustainable engineering design;
5. To expose students to real world product development process and popular engineering tools;
6. To promote global perspective for engineering students as a basic skill to design products for global market;
7. To give students contextualized instruction and experience in technical communication.

101051238 Electrical & Electronics I

The course introduces electric circuits for non-major in electrical engineering. It covers circuit analysis and analog circuit analysis. The content and topic of this course are designed explicitly to meet the needs of the non-majors and are relevant to their major area of study.

Prerequisite(s): Calculus A, Physics

101051239 Electrical & Electronics II

The course introduces electric circuits for non-major in electrical engineering. It covers digital circuit analysis, motors, transformers, elementary controlling circuits. The content and topic of this course are designed explicitly to meet the needs of the non-majors and are relevant to their major area of study.

Prerequisite(s): Calculus A, Physics

101051295 Electrical & Electronics Lab I
The course introduces electric circuits for non-major in electrical engineering. It covers circuit analysis, and analog circuit analysis. The content and topic of this course are designed explicitly to meet the needs of the non-majors and are relevant to their major area of study.

Prerequisite(s): Calculus A, Physics

101051296 Electrical & Electronics Lab II
The course introduces electric circuits for non-major in electrical engineering. It covers digital circuit analysis, motors, transformers, elementary controlling circuits. The content and topic of this course are designed explicitly to meet the needs of the non-majors and are relevant to their major area of study.

Prerequisite(s): Calculus A, Physics

101062102 Electric Circuit Experiment
This course is one of the most important experiment courses of Electrical Specialty in colleges and universities. Students are required to grasp the necessary basic knowledge of circuit analysis when learning this course. The primary content of the "circuit experiments" includes analysis of the circuit, exploring and verifying the basic laws as well as analysis methods of electric circuit, it has a broad background of engineering. And it plays a significant role in establishing a rigorous scientific attitude and engineering viewpoint of applying theory to reality. It simultaneously does good to develop scientific thinking skills and capacity of experimental research and scientific induction. Furthermore, through the curriculum, we will reach to the purpose that students could deepen the understanding of essential theoretical knowledge as well as measurement and analysis methods of circuit while they could master the basic skills of circuit experiment.

Prerequisite(s): Mathematical Analysis for Engineering, Physics

101063107 Digital Logic Circuit and CPU
This course covers principles of binary numbers, digital systems, assembly language programming, and gives an overview of computer architecture. It provides a background in basic technology areas that are required to understand computer architecture and design.

Prerequisite(s): Students should be familiar with Kirchoff's laws, analysis of basic electrical and electronic circuits.

101080081 Computer Science and Programming
This course introduces the basic concepts of computer science and the art of C programming. The students will learn how to think algorithmically and solve problems efficiently. Topics include: computer systems, data representation, programming basics, algorithms, data structures, software engineering, control flows, functions and program structures, pointers and arrays, structures, and file manipulations. Visual C/C++ or any other Integrated Development Environment will be used throughout the course. Extensive programming exercises will be given to ensure proficiency with C. All assignments will be submitted through a Moodle-based CMS system.

101080082 C Programming Practice
In this course, the students will work in a group of 3-6, simulating a software development team as in real settings. Each team will decide the topic of the project, and solve real problems along the way. Supervisors are available for supports and feedback. A gamified approach will be taken and game metaphors (such as quests and experience points) will be used throughout the course.

This is a “flipped” course, meaning that most of the learning will happen AFTER class. Class time will be used for student presentations, discussions and problem solving. All assignments will be submitted through a Moodle-based CMS system.

Prerequisite(s): Computer Science and Programming

101180111 College Physics I

This course is the first half of a one-year introduction to physics. It satisfies the requirements for a standard introductory physics course for scientists and engineers, and focuses on development of scientific reasoning and problem-solving skills. The course material covers a wide range of topics with a clear and logical presentation of the basic concepts and principles of physics. The topics include: kinematics; linear and rotational motion; Newton’s dynamics of motion; conservation of momentum and energy; kinetic theory of gases; thermodynamics; oscillations and waves; and wave optics. Multivariable and vector calculus is used extensively in the course. There are no separate labs or discussion sections.

Prerequisite(s): Mathematics preparation at least one semester of calculus is required. However, some elementary ideas and skills from multivariable and vector calculus are used and students are encouraged to take Applied Mathematics concurrently.

101180121 College Physics II

This course is a calculus-based physics course for science and engineering majors. The topics cover: Charge and matter, Electric field, Gauss’s law, Electric potential, Capacitors and dielectrics, Current and resistance, Electromotive force and circuits, Magnetic field, Ampere’s law, Faraday’s law, Inductance, Maxwell’s equations, Special Relativity, Wave and particle duality, Matter waves, Schrödinger’s equation, The course emphasizes the understanding of the physics concepts and principles, equips the students with effective problem-solving skills. The students should be able to apply physics principles to real-world problems.

Prerequisite(s): Higher Mathematics, College Physics I

102172501 Linear Algebra A

The course introduces the elements of linear algebra, include matrix algebra, linear system, vector space, linear transformation, determinant, eigenvalues, orthogonality. The course also introduces the logical sequence of advanced mathematics, in particular to the role and construction of proofs. The students should be able to apply linear algebra and matrices in mathematics and practical issues.

104210001 Introduction to Management

This course is an introductory level management course that deals with the principles of management theory and practice. This course provides instruction in principles of management that have general applicability to all types of organizations. Emphasis is placed on the functional approach including planning, organizing, leading, and controlling. To learn and understand the basic management principles in order to build a solid foundation for future career success. The goals of this course are to provide a broad base of knowledge about organizations, about the environments in which they operate, and about the related roles and responsibilities of managers. This course will provide the opportunity to use this knowledge to develop specialized skills and competencies crucial to the successful leadership of modern organizations.

104210004 Essentials of Economics

Essentials of Economics is an introductory undergraduate course that teaches the fundamentals of economics. It provides a foundation for many years of study in economics, business, or related fields, as well as for economic analysis and thinking that can last throughout the students’ education and subsequent professional careers. This course provides an introduction to economics concepts and issues. It will introduce demand and supply, how market prices are determined, the production function, output and various cost curves, how the entire economy operates and the role of government in fostering an environment in which prices are stable, unemployment is low and the economy is growing. We will also explore the basis of and benefits from trade and the determination of the exchange rate. The entire course is built around the development and usage of demand and supply analysis in order to address a variety of issues that are important to economists, policy makers and the average citizen.

Course Syllabus

100051294 Electronic Practice (Radio Installation)

Lecture Hours: 0
Laboratory Hours: 16
Credits: 1
Term (If necessary): Sophomore (First semester)
Prerequisite(s): Physics A II

Course Description:
This course is a comprehensive practice course. Through the 6 tube heterodyne transistor radio production and debugging, it can cultivate student's comprehensive hands-on practical ability. The content and topic of this course are designed explicitly to meet the needs of the non-majors and are relevant to their major area of study.

Course Outcomes:
After completing this course, a student should be able to:
1. Read and write diagram according to the product schematic diagram;
2. Identify a variety of component symbols on a product map corresponding to physical objects.
3. Master the use of multimeter and general welding method;
4. Work rigorously and meticulously according to product technical requirements;
5. Collect information, analysis and solve problem, so as to write an internship summary report.

Course Content:
Lectures and Lecture Hours:

1. Introduction	2
- Experimental purpose and requirements	
- The principle of radio and its welding process	
- Radio detection and debugging methods	
2. With special printing plate for welding process training	2
3. Radio component detection and recording	2
4. Install the radio as instructed and welding components	6
5. Detection, commissioning and fault analysis	3
6. Write an internship report	1

Laboratories and Laboratory Hours:
See 101051294 'Electronic Practice (Radio Installation)'.

Grading:

Evaluation of radio production process	40%
Acceptance of performance index	40%
Summary practice report	20%

Textbooks and References:
Text: Radio frequency modulation (AM) radio instruction book
Reference Book: Fundamentals of Circuit Analysis, Analog Electronic Technology Foundation

100062203 Digital Fundamentals Lab

Lecture Hours: 0
Laboratory Hours: 24
Credits: 0.75
Prerequisite(s):Physics, Circuit Analysis

Course Description:

The course is the laboratory supplement to "Analog Fundamentals". Basic analog circuits and theory of operation amplifiers are covered in the course. It consists of experiments on amplifier, feedback amplifier, operational amplifier application, voltage regulator application, voltage controlled oscillator.

Course Outcomes:

After completing this course, a student should be able to:

1. Systematically master the basic skills of analog circuit measurement and troubleshooting.
2. Analyze and design circuits with EDA.
3. Choose the suitable ICs and design circuits.
4. Analyze lab data, write lab report .

Course Content:

Laboratories and Laboratory Hours:

1. Applications of circuit measure devices 1
   - Measure the frequency, period and amplitude of the out signal of the function generator by oscilloscope
   - Measure the signal phase with oscilloscope scanning mode and X-Y mode
2. Common emitter amplifier 3
   - Measure the quiescent values and voltage gain
   - Measure the influence of RB, RC, RL on voltage gain and output waveform
   - Measure input and output resistances
3. Multistage and negative feedback amplifiers 4
   - Adjust and test the quiescent values of multistage amplifier
   - Measure voltage gain and frequency bandwidth of two-stage amplifier with no feedback
   - Measure voltage gain and frequency bandwidth of two-stage amplifier with negative feedback
4. Op-Amp applications 5
   - Design the proportion, addition and integration circuits with uA741
   - Design a Wien bridge sine oscillation circuit with uA741, wave conversion with LM393
5. Design of voltage controlled function generator 6
   - Design a voltage controlled function generator circuit to generate square, triangle and sine waves.
   - Debug the voltage controlled function generator
6. Application of the integrated voltage regulator 2
   - Design the voltage expansion circuit and the current expansion circuit with W7800 and W7900
7. EDA application 3
   - Simulate the analog circuit with EDA
8. Other analog project 2
   - Design an innovative analogy circuit with practical effect independently and debug it

Grading:

Circuit design, debug	30%
Lab report	20%
Exams	50%

<u>Text & Reference Book</u>:

Text Book:

Zhang Yuping, Electronics Experiment, 2008, ISBN 9787564013141.

Reference Books:

Wang Yuan. Analog Fundamentals, 3^{th} ed. 2007. ISBN 9787111042105.

Zhang Huimin, Experiment and Curriculum Project on Electronics, 2017, ISBN 9787121292835

100070003 Foundations of Computer Application

Lecture Hours: 20
Laboratory Hours: 12
Credits: 2
Prerequisite(s): None

Course Description:

This course is a compulsory course for the students who are not majoring in computer or the correlative majors. The goal of this course is to guide students to understand the evolution, essential concepts, core methods and technology of computer science, making them understand the overview and branches of computer science, grasp relevant basic knowledge, and form Computational Thinking consciousness. The final purpose of this course is to foster the students' interest to computer science and utilize the computer as an appliance and get them prepared for future study which may be related to computer science.

Course Outcomes:

After completing this course, a student should be able to:
1. Understand relevant knowledge of Computational Thinking.
2. Understand the definition and components of a computer, and the category of computers.
3. Understand the basic ideas in Information digitization
4. Understand the principles of computer organization.
5. Understand the definition and category of computer software, and the evolution and functions of operating systems.
6. Understand the basic concepts of algorithm design and programming languages.
7. Understand the concepts and typical models of computer networks and security.
8. Understand the concepts of database.

Course Content:

Lectures and Lecture Hours:

1. Problem Solving based on Computer 4
   Problem description and abstraction
   Problem solving method based on Computer
   Domain knowledge of Computer Science
2. Foundation of Computer Information digitization 3
   Number system and number system conversion
   Binary numerical representation and calculation
   Character information encoding and standard exchange
   Multimedia information coding
   Barcode and RFID
   Information standardization
3. Computer working principle and hardware architecture 4
   Development of computer and Turing machine model
   Hardware composition of a computer
   Basic working principle of computer
   Microcomputer architecture
   Performance indicators for Microcomputers
   Parallel computer architecture

4 Computer software platform 4
   Computer software platform overview
   Data storage and file management
   Program running management
   Practical operating system

5 Computer network platform 4
   Computer network platform

Internet and Its Applications	
Information security	
Cloud computing services	
Internet of things based on network platform	
6 Data processing and Data Base	5
Data and data processing	
Multimedia data processing	
Database technology foundation	
Introduction to SQL	
Data warehouse and data mining	
WWW Database Technology	
7 Computation and Computational Sciences	2
The nature of computation	
About computational discipline	
Pervasive computing and Its Applications	
8 Algorithm and program design	4
Algorithm	
Algorithm design of typical problems	
Data structure	
The general process of programming	
9 Final review	2

Grading:

Final exam	60%
Experiments	10%
MOOC	20%
Quiz and attendance	10%

Text & Reference Book:

Li Fengxia, Chen Yufeng, Shi Shumin. College Computer, Higher Education Press, 2014
Li Fengxia. College Computer Experiment, Higher Education Press, 2014

100070008 Database Technology and Application

Lecture Hours: 32
Laboratory Hours: 16
Credits: 3
Prerequisite(s): Computer Basics

Course Description:

This course is to explore how to use Access Database, VBA and SQL to create Database application system. The course is a basic course for computer applications, suitable for undergraduates of all majors. Through the study of this course, the students should be familiar with database design and operation, including the design and use of the database table, query, form, PivotTable / maps, reports, data access pages, macros and modules, and access support for Internet, database security management, etc. so as to achieve the ability to develop simple database application system, and lay the foundation for future study and application development.

Course Outcomes:

After completing this course, a student should be able to:
1. Master the basic theory of database technology and application
2. do Database analysis and design (1NF, 2NF, 3NF)
3. Use seven objects to develop a simple database application system
4. Use VBA and SQL to develop a simple database application system

Course Content:

Lectures and Lecture Hours:

Chapter 0 Introduction to the course 1

Chapter 1 Basic concepts of database 3

1. Relational database basics
2. Relational computing
3. Relation normalization basics
4. Introduction to Access

Chapter 2 Database and data table 4

1. Database operations
2. Data table establishment
3. Basic operation of data table

Chapter 3 Query 4

1. Basic concepts of query
2. Create select queries
3. Create calculation queries
4. Create special purpose queries
5. Create an action query
6. Create SQL queries

Chapter 4 form 2

1. Understanding forms
2. Create forms
3. Form controls
4. Format forms

Chapter 5 Report creation and operation 4

1. Basic concepts of report
2. Create reports
3. Design reports
4. Advanced design of reports

5．Modify Report	
Chapter 6 Web data access page	2
1．Overview of data access pages	
2．Create data access pages	
3．Edit data access pages	
Chapter 7 macro	4
1．Macro concept	
2．Create macros	
3．Run macros and debug macros	
Chapter 8 Modules and VBA	4
1．VBA basics	
2．VBA program structure	
3．Object Oriented Programming basics	
4．Basic concepts of modules	
5．Process calls and program debugging	
Chapter 9 Design, development and release of Access application system	2
1．Develop student achievement management system	
2．Mainten student achievement management system	
Design example and summary review 2	

Laboratories and Laboratory Hours:

1．Access installation and startup, database creation and maintenance	2
2．Create tables and input data	2
3．Design queries	2
4．SQL programming	2
5．Design forms	2
6．Design reports	2
7．Design macros	2
8．VBA programming	2
9．Design some database application systems (after class time)	

Grading:

Usual grades	10%
Homework	30%
Final	60%

Text & Reference Book:

刘东，刘丽．Access 数据库基础教程（M），北京：科学出版社，2012，ISBN 978-7-03-033675-0.

李玉霞，刘丽．Access 2010 数据库基础教程（M），北京：中国铁道出版社，2016，ISBN 978-7-113-20377-1.

100070015 Multimedia Technology

Lecture Hours: 32
Laboratory Hours: 0
Credits: 2
Prerequisite(s): Computer Science Introduction, Operating Systems, Computer Networks

Course Description:
This course is an elective course for upper-level undergraduates major in Computer Science and Technology. It aims to equip the students with fundamental multimedia technology which is required in multimedia research and application development. The course covers the theoretical and practical aspects of multimedia technologies, including multimedia data compression, multimedia computer systems and software development environment, multimedia content management, multimedia communications, new technologies and applications in multimedia, etc.

Course Outcomes:
After completing this course, a student should be able to:
1. Build the framework of multimedia technologies including the fundamental concepts and principles.
2. Know about the hardware, software, systems of multimedia, including the related technical standards.
3. Analyze the development of multimedia technologies, and get insight into the future development.
4. Design and develop multimedia applications using multimedia tools and development platforms.

Course Content:
Lectures and Lecture Hours:

1. Introduction	2
- Concepts of multimedia	
- Development of multimedia technology	
- Contents of multimedia research	
- Applications and prospects about multimedia technology	
2. Multimedia data compression	4
- Overview of data compression	
- General data compression techniques	
- Digital image coding	
- Media data conversion	
3. Standards for multimedia data coding	4
- JPEG	
- MPEG	
- H.26X	
- Audio coding and its standards	
4. Multimedia computer systems	4
- Multimedia storage technology	
- CD-ROM and the related standards	
- Equipments related to multimedia	
- Multimedia personal computer system	
5. Multimedia software development environment	2
- Multimedia application development	
- Multimedia data acquisition	
- Multimedia authoring tools	
- Multimedia programming	
6. Multimedia content management	6

- Multimedia data management environment
- Multimedia database management system
- Content-based retrieval
- Multimedia content security and copyright protection

7. Hypertext and Web system 2
   - Concepts of hypertext
   - Hypertext system architectures
   - Hypertext literature models
   - Hypertext markup language
8. Multimedia Communications 2
   - Multimedia and communication
   - Typical multimedia communication systems
   - Multimedia communication networks
   - Quality of service in multimedia communications
9. Multimedia technologies based on Internet 2
   - Multimedia applications based on Internet
   - Multicasting
   - Stream media
   - QoS guarantee over Internet
10. New multimedia technologies and applications 4
    - MPEG-21 and e-business
    - Intelligent human-computer interaction
    - Virtual reality and augmented reality

Laboratories and Laboratory Hours: None

Grading:

Inclass Quizzes	10%
Project	30%
Final	60%
Instructor Evaluation	5%

Text & Reference Book:
Textbook:
H. Ma. Principles and applications of multimedia technology, Second edition, 2008, ISBN 9787302176756. (in Chinese)
Reference books:
P. Havaldar, G. Medioni, Multimedia systems : algorithms, standards, and industry practices, China student edition, 2015, ISBN 9787111499299.

100160501 Principle of Life Science A

Lecture Hours：32
Credits: 2
Term (If necessary)
Prerequisite(s): None

Course Description

This course introduces the basic knowledge in life science, which includes: the basic concepts of modern biology, the principle, the method and the important branches, focus will be put on the interdiscipline of life science, as well as its application in different fields. Human health, nutrition, sanitation are important in everyday life. The lack of knowledge in these areas will generate rumors and pseudo science. The course will construct the knowledge system, build a comprehensive scientific literacy for the students as the citizens in the new era.

Course Content

Lectures and lecture hours:

Chapter 1 introduction	**2**
1.1 The Development and Present Situation of Life Science (1 hours)	
1.2 The research methods of life science (0.5 hours)	
1.3 The relationship between life sciences and other disciplines (0.5 hours)	
Chapter 2 The Basis of Life and Cell	**5**
2.1 Elements of life (0.5 hours)	
2.2 Biomacromolecule (1 hours)	
2.3 The basic structure of cells (1.5 hours)	
2.4 Cell proliferation and regulation (1 hours)	
2.5 Cell differentiation and death (1 hours)	
Chapter 3 The basic structure and development of animals	**3**
3.1 The basic structure of animals and the human (1.5 hours)	
3.2 The basic process of human development (1 hours)	
3.3 Adjustment of growth and development (0.5 hours)	
Chapter 4 The molecular basis of genetic and genomics	**4**
4.1 The molecular structure and function of DNA (1 hours)	
4.2 Genetic variation and effects (1 hours)	
4.3 Common human genetic diseases (1 hours)	
4.4 Genomic Research and Application (1 hours)	
Chapter 5 Biological Defense Systems and Human Health	**6**
5.1 Body immunity and defense system (2 hours)	
5.2 The mechanism of cancer, treatment and prevention (1 hours)	
5.3 Mechanism of cardiovascular disease, treatment and prevention (1 hours)	
5.4 Infectious diseases and their prevention (1 hours)	
5.5 Nutrition and Health (1 hours)	
Chapter 6 Biological evolution	**2**
6.1 Biological theory of evolution (1 hours)	
6.2 Human evolutionary history (1 hours)	
Chapter 7 Environment Protection and Biodiversity	**3**
7.1 Ecosystem (1 hours)	
7.2 Human and Environment (1 hours)	
7.3 Biodiversity (1 hours)	
Chapter 8 Modern Biotechnology and Its Applications	**5**

8.1 Genetic engineering (1 hours)
8.2 Cell Engineering (1 hours)
8.3 Protein and Enzyme Engineering (1 hours)
8.4 Fermentation Technology (1 hours)
8.5 Biotechnology frontier (1 hours)
(Note: this part of the content can make some changes according to the specific circumstances and scientific progress in each round of teaching)

Grading

Inclass activity	30%
Final exam	70%

Reference Books

[1]Wang Jinting, Ma Hong, Wang Yujiang. Introduction to Life Sciences [M]. Wuhan: Huazhong University of Science and Technology Press, 2014.
[2]Gao Chongming. Introduction to life sciences [M]. Beijing: Higher Education Press, 2013.
[3]E. D. Enger, F. C. Ross. Principles of Biology [M]. Beijing: Science Press, 2004.
[4]N. A. Campbell, J. B. Reece. Essential Biology [M]. Beijing: Higher Education Press, 2013.
[5]Wu Qingyu. Basic Life Sciences (Second Edition) [M]. Beijing: Higher Education Press, 2006.

100160502 Principle of Life Science B

Lecture Hours：24
Credits：1
Prerequisite(s)：None

Course Description

This course summarizes the basic knowledge in life science, which includes the basic concepts of modern biology, the principle, the method and the important branches. Focus will be put on the interdiscipline of life science, as well as its application in different fields. Human health, nutrition, sanitation are important in everyday life. The lack of knowledge will generate rumors and pseudo science. The course will construct the knowledge system, build a comprehensive scientific literacy for the students as the citizens in the new era.

Course Content

Lectures and lecture hours

Chapter 1 introduction **1**
1.1 The Development and Present Situation of Life Science (0.4 hours)
1.2 The research methods of life science (0.4 hours)
1.3 The relationship between life sciences and other disciplines (0.2 hours)
Chapter 2 The Basis of Life and Cell **4**
2.1 Elements of life (0.5 hours)
2.2 Biomacromolecule (1 hours)
2.3 The basic structure of cells (1.5 hours)
2.4 Cell proliferation and regulation (0.5 hours)
2.5 Cell differentiation and death (0.5 hours)
Chapter 3 The molecular basis of genetic and genomics **3**
3.1 The molecular structure and function of DNA (0.5 hours)
3.2 Genetic variation and effects (0.5 hours)
3.3 Common human genetic diseases (1 hours)
3.4 Genomic Research and Application (1 hours)
Chapter 4 Biological Defense Systems and Human Health **5**
4.1 Body immunity and defense system (1 hours)
4.2 The mechanism of cancer, treatment and prevention (1 hours)
4.3 Mechanism of cardiovascular disease, treatment and prevention (1 hours)
4.4 Infectious diseases and their prevention (1 hours)
4.5 Nutrition and Health (1 hours)
Chapter 5 Biological evolution **2**
5.1 Biological theory of evolution (1 hours)
5.2 Human evolutionary history (1 hours)
Chapter 6 Modern Biotechnology and Its Applications **5**
6.1 Genetic engineering (1 hours)
6.2 Cell Engineering (1 hours)
6.3 Protein and Enzyme Engineering (1 hours)
6.4 Fermentation Technology (1 hours)
6.5 Biotechnology frontier (1 hours)
(Note: this part of the content can make some changes according to the specific circumstances and scientific progress in each round of teaching)

Grading

30% of usually, 70% of the final exam.

Books and References

[1]Wang Jinting, Ma Hong, Wang Yujiang. Introduction to Life Sciences [M]. Wuhan: Huazhong University of Science and Technology Press, 2014.
[2]Gao Chongming. Introduction to life sciences [M]. Beijing: Higher Education Press, 2013.
[3]E. D. Enger, F. C. Ross. Principles of Biology [M]. Beijing: Science Press, 2004.
[4]N. A. Campbell, J. B. Reece. Essential Biology [M]. Beijing: Higher Education Press, 2013.
[5]Wu Qingyu. Basic Life Sciences (Second Edition) [M]. Beijing: Higher Education Press, 2006.

100171301 Probability Theory and Mathematical Statistics

Lecture Hours: 48
Laboratory Hours: 0
Credits: 3
Prerequisite(s): Mathematical Analysis

Course Description:

This course is to explore the mathematical modeling of random problems. Beyond the classical probability calculation, we will give a modern strict foundation of stochastic problems according to Kolmogorov. Stemming from the typical Binomial, Poisson, Normal random variables, we will establish the general notion of random variable and its distribution. Then we can explore the proofs and the applications of the crucial limit theories including large number theory and central limit theory.

Course Outcomes:

After completing this course, a student should be able to:

1. Develop mathematical models of random problems using random variable and its distribution.
2. Calculate the probability and the numerical characteristics of random variables as desired.
3. Give proofs to analytic problems in probabilistic view.

Course Content:

Lectures and Lecture Hours:

1. Events and Probability	6
2. Conditional Probability and Independence	8
3. Random Variables and Distribution Functions	12
4. Numerical Characteristics and Characteristic Function	12
5. Limit Theories	8
6. Reviews and tests	2

Grading:

Homework	10%
Inclass Quizzes	10%
Final	80%

Text & Reference Book:

Xian-Ping Li, *Elementary Probability*, Higher Education Press, Beijing, 2010. (in Chinese)
Xian-Ping Li and Zi-Yi Chen, *Instruction Book of Elementary Probability*, Higher Education Press, Beijing, 2011. (in Chinese)

100172001 Complex Variables and Integral Transforms

Lecture Hour: **32**
Credits: **2**
Prerequisite(s): Advanced Calculus,Linear Algebra

Course Description:
The course introduces the complex variable theory and its applications involving Fourier Transform and Laplace Transform.

Course Outcomes:
After completing the course, the students should be able to:
- understand the complex variable theory;
- know how complex variable theory is used to evaluate certain integrals with the residue theorem;
- solve a variety of problems arising in the application fields such as signal processing, Image processing.

Course Content:
Lectures and Lecture Hours:

Chapter 1 Complex Number and Complex Function 3
1. Expression of Complex Number and its Operation
2. Products and Powers in Exponential Form
3. Regions in the Complex Plane
4. Limit and Continuity of Function

Chapter 2 analytic function 3
1. Definition of analytic function
2. Cauchy-Riemann Theorem
3. Elementary Functions

Chapter 3 Integrals 5
1. Definite Integrals of Functions
2. Cauchy-Goursat Theorem
3. Anti-derivative, Fundamental Theorem of Calculus,
4. Cauchy Integral Formula
5. An Extension of the Cauchy Integral Formula
6. Harmonic Function

Chapter 4 Series 4
1. Convergence of Series
2. Power Series
3. Taylor's theorem
4. Laurent's theorem and Isolated Singular Points

Chapter 5 Residues 5
1. Residues
2. Cauchy's Residue Theorem
3. Application of Residues

Chapter 6 Fourier Transform 8
1. Fourier Integral
2. Properties
3. convolution and δ-Function

Chapter 7 Laplacian Transform 4
1. Laplacian Transform Theorem
2. Elemental Properties
3. Inverse Laplacian Transform
4. Convolution Formula

Grading:

Homework	10%
Group Presentation	5%
Final	85%

Text & Reference Book:
James Ward Brown, Ruel V. Churchill, Complex variables and applications, 8th ed., 2009
ISBN 0–07–305194–2.

100172002 Linear Algebra B

Class Hours: **48**
Credit: **3**

Course Description

This course is required for the students major in engineering, management, etc. Its purpose is to provide an introduction to linear algebra, a branch of mathematics dealing with matrices and vector spaces. Its fundament concepts, theories and methods are the foundation of many modern science theories and engineering technologies, such as differential equation, matrix analysis, physics, control theory, information science, chemistry, biology, economics, business, and so on.

Course Outcomes:

The objective of this course is to make the students master the essential theories and methodologies of matrices, system of linear equations, vector spaces, determinant, eigenvalues and eigenvectors, quadratic form, develop their abilities of abstract thinking and reasoning, possess the capacity for solving real problems by using knowledge of linear algebra.

100172003 Probability Theory and Mathematical Statistics

Lecture Hours: 48
Laboratory Hours: 0
Credits: 3
Term(If necessary):
Prerequisite(s): Calculus

Course Description:

This course is a public basic course for undergraduate students, and it is a mathematical course to study the random phenomena. This course provides an elementary introduction to probability and statistics with applications. Topics include: basic probability models, random variables, discrete and continuous probability distributions, law of large numbers, central limit theorem, statistical estimation and testing. Probability and mathematical statistics have a very wide range of applications. In this course, we will give some introduction about the basic concepts, theories and methods in probability theory and mathematical statistics. The purpose of this course is to familiarize students with main methods of probability and statistics to deal with practical problems and even to lay some foundation for the forthcoming study.

Course Outcomes:

After completing this course, a student should be able to
1. Be familiarize with main methods of probability theory and mathematical statistics.
2. Design probability model and statistical model in many fields.
3. Use main methods of probability and mathematical statistics to deal with practical problems.
4. Lay some foundation for the forthcoming study.

Course Content:

Lectures and Lecture Hours:

Chapter 1 Basic Concepts of Probability	8
Chapter 2 Random Variables and Distributions	8
Chapter 3 Multivariate Random Variables and Distributions	8
Chapter 4 Digital Characteristic of the Random Variable	8
Chapter 5 Law of Large Numbers and Central Limit Theorem	2
Chapter 6 Sample and Sampling Distributions	4
Chapter 7 Parameter Estimation	6
Chapter 8 Hypotheses Testing	6

Grading:

Homework, Quiz, and Attendance: 20%~30%
Final Exams: 70%~80%

Text & Reference Book:

Sheng Zhou, Xie Shiqian, Pan Chengyi, Probability and Mathematical Statistics , 4th ed., 2008, ISBN 978-7-04-023896-9.

100172101,100172102 Calculus A

Lecture Hours: 192
Credits: 12
Prerequisite: None

Course Description:

Calculus A is a two-semester compulsory course for the undergraduates major in the general engineering (except Electronics and Communications Engineering, Computer Application Technology etc.). Through the studying of this course, students will master basic concepts, basic theory and basic computing skills of calculus. The course can cultivate students' ability of understanding mathematical language, abstracting general problem, logical reasoning, spatial imagination and skilled computing. In addition, the course can cultivate students the ability to analyze and solve practical problem and lay fundamentals to study the follow-up courses.

Course Outcomes:

Upon successfully completing this course, students should be able to:

1. Understand the following concepts: limits and continuity of single-variable and multivariable functions, the derivative and partial derivative, the integral, the multiple integral, curve and surface integral, infinite series and differential equation.
2. Compute derivatives and basic integrals of functions;
3. Apply the methods of calculus to solve integrals involving integration by substitution, integration by parts and partial fraction decomposition;
4. Solve ordinary differential equations;
5. Determine the convergence of series using p-series, alternating series test, and ratio and toot tests;
6. Recognize and determine the radius of convergence and interval of convergence for power series;
7. Apply the concepts in calculus to model and solve the problems in geometry, physics and other fields.

Course Content

The content of calculus A includes: function, limits and continuity, single-variable calculus, ordinary differential equation, vector algebra and space analytic geometry, multivariable calculus and infinite series.

Lectures and Lecture Hours:

Chapter 0 Preliminaries	4
Section1 Set and Interval	
Section 2 Function	
Chapter1 Limit and Continuity of a function	16
Section 1 The Limit of Sequence	
Section 2 The Limit of a Function	
Section 3 Calculating Limits using the Limit Laws	
Section 4 Two Important Limits	
Section 5 The Infinitesimal and Infinity	
Section 6 The Continuity of a Function	
Section 7 The Comprehensive Example	
Chapter 2 Derivative and Differentiate	12
Section 1 The Concept of Derivative	
Section 2 Differentiation Rules and Basic Differentitant Formulas	
Section 3 Implicit Differentiation and Parameter Equation Derivation	
Section 4 Higher order derivative	
Section 5 The Differentiation of Functions	
Section 6 The Comprehensive Example	

Chapter 3 The Mean Value Theorem and Application of Differentiation 20

Section 1 The Mean Values Theorem

Section 2 L'Hoptital's Rule

Section 3 Taylor Formula

Section 4 Studying on the Property of Function

Section 5 Curvature of Curve

Section 6 The Comprehensive Example

Chapter 4 Single Variable Integral Calculus 24

Section 1 The Concept and Properties of Definite Integral

Section 2 Fundamental Theorem of Calculus

Section 3 Indefinite Integrals

Section4 Calculation of definite Integral

Section5 Improper Integral

Section6 Geometric Application of Definite Integral

Section7 Physical Application of Definite Integral

Section8 The Comprehensive Example

Chapter 5Ordinary Differential Equations 20

Section1 The Concept of Differential Equations

Section 2 First-order differential Equations

Section 3 Higher Order Differential Equation with Reduced Order

Section 4 The structure for the solutions of Linear Ordinary Differential Equations

Section 5 Homogeneous Linear Ordinary Differential Equation with Constant Coefficients

Section 6 non-Homogeneous Linear Ordinary Differential Equation with Constant Coefficients

Section 7 Systems of Linear Ordinary Differential Equation with Constant Coefficients

Section8 Mathematical Modeling – The application of Differential Equations

Section 9 The Comprehensive Example

Chapter6 Vector Algebra and Space Analytic Geometry 16

Section1 Rectangular coordinate System in Space

Section2 Vector and Its Linear Operation

Section3 Product of Vector

Section4 Planar Equation

Section5 Space Straight Line Equation

Section6 Space Surface and Space Curve

Section7 Quadric Surfaces

Section8 The Comprehensive Example

Chapter 7 Multivariable Differential Calculus 20

Section 1 Limit and Continuity of Multivariate Function

Section 2 Partial Derivatives

Section 3 Total Differentiation

Section 4 Differential Method of Composite Function and Implicit Function

Section5 Directional Derivative and Gradient

Section 6 The Application of Differential Calculus in Geometry

Section7 Taylor Formula of Two Function

Section8 The Extreme Value of Multiple Function

Section9 The Comprehensive Example

Chapter8 Multiple Integrals 18

Section1 The Concept and Properties of Multiple Integrals

Section2 Computation of Double Integrals

Section3 Computation of Triple Integrals

Section4 Application of Multiple Integrals

Section5 Substitutions in Multiple Integrals

Section 6 The Comprehensive Example

Chapter9 Line Integrals and Surface Integrals 20

Section1 Line Integrals of The First Type

Section2 Line Integrals of The Second Type

Section3 Green's Theorem, The Condition of Plane Curve Integral and Path Independent
Section4 Surface Integrals of The First Type
Section5 Surface Integrals of The Second Type
Section6 Gauss Formula and Divergence
Section7 Stokes Formula and rotation
Section 8 The Comprehensive Example

Chapter 10 Series 22

Section 1 The Concept and Properties of Constant series
Section 2 Positive Series
Section 3 Arbitrary Series
Section 4 Power Series
Section 5 Representations of Functions as Power Series
Section6 Fourier Series
Section7 The Comprehensive Example

Grading:

Homework	10%
In class Presentation	10%
Quizzes and Tests	20%
Final Exam	60%

Text & Reference Book:

The textbook for this course

[1]Ruiqi Zhang, Yihong Chen, Calculus(I) , 2008, ISBN 7-111-17259-0. China Machine Press.
[2]Ruiqi Zhang, Yihong Chen, Calculus(II) , 2008, ISBN 7-111-18326-6. China Machine Press.

Reference Books

[1]Jingzhong Mao, Advanced Mathematics(I), 2008, ISBN 978-7-04-023603-3, Higher Education Press.
[2]Jingzhong Mao, Advanced Mathematics(II), 2008, ISBN 978-7-04-023604-0, Higher Education Press.
[3]Department of Mathematics of Tongji University, Advanced Mathematics(I), 5thed, 2003, ISBN7-04-010820-8, Higher Education Press.
[4]Department of Mathematics of Tongji University, Advanced Mathematics(II), 5thed, 2003, ISBN7-04-010821-6, Higher Education Press.

100172103/203 Mathematical Analysis for Engineering

Lecture Hours: 196
Laboratory Hours: 0
Credits: 12
Term(If necessary): First year of college
Prerequisite(s): None

Course Description:
This course introduces the basic concepts, basic theories and basic methods of calculus, so as to foster the students' capabilities of theoretical analysis, mathematical arguments, and skilled mathematics calculation. After completing this course, the students will be equipped with certain abilities of abstract thinking, logical reasoning, and spatial imagination, and most importantly, putting what they learn into practice. This course also lays the foundations for future study of subsequent courses.

Course Outcomes:
After completing this course, a student should be able to:
1. Understand the basic concepts, basic theories and basic computing skills of calculus.
2. Know well the basic methods of theoretical analysis, mathematical arguments, and skilled math calculation.
3. Possess the abilities of abstract thinking, logical reasoning, and spatial imagination.
4. Use knowledge learnt to analyze and solve practical problems.

Course Content:
Lectures and Lecture Hours:
Chapter 1 Functions, Limits and Continuity 20
Section 1 Functions
Section 2 The Concept of a Limit
Section 3 Properties of a Limit
Section 4 Infinite and Infinitesimal
Section 5 Operation Laws of a Limit
Section 6 Criterions for Existence of a Limit and Two Important Limits
Section 7 Comparison of Infinitesimals
Section 8 Continuity of a Function
Section 9 Examples
Chapter 2 Derivative and Differential 14
Section 1 The Concept of a Derivative
Section 2 Differential Rules
Section 3 Implicit Differentiation and Parametric Equations Differentiation
Section 4 High-Order Derivative
Section 5 Differential
Section 6 Examples
Chapter 3 The Mean Value Theorem and Applications of Differentiation 18
Section 1 The Mean Value Theorem
Section 2 L'Hospital's Rule
Section 3 Monotonicity and Extremum of a Function
Section 4 Concavity and Asymptotes of a Curve, Curve Sketching
Section 5 Curvature of a Curve
Section 6 Taylor's Formula
Section 7 Approximate Solutions of a Function
Section 8 Examples
Chapter 4 Definite Integrals and Indefinite Integrals 26
Section 1 The Concept and Properties of Definite Integrals
Section 2 The Fundamental Theorem of Calculus

Section 2 Series with positive terms
Section 3 Series with any terms
Section 4 Power Series
Section 5 Taylor Series
Section 6 Fourier Series
Section 7 Examples

Laboratories and Laboratory Hours: None

Grading:

Homework	10%
In class Presentation	10%
Quizzes and Tests	20%
Final Exam	60%

Text & Reference Book:

Text

[1] Jing Zhongmao, Advanced Mathematics I, first edition, 2008, ISBN 978-7-04-023603-3.
[2] Jing Zhongmao, Advanced Mathematics II, first edition, 2008, ISBN 978-7-04-023604-0

Reference Book:

[1] Department of Applied Mathematics, Tongji University, Advanced Mathematics I 5Th ed. 2002. ISBN 7-04-010820-8
[2] Department of Applied Mathematics, Tongji University, Advanced Mathematics II 5Th ed. 2002. ISBN 7-04-010821-6
[3] Runqi Zhang, Yihong Chen, Calculus I. first edition, 2011. ISBN 978-7-111-17259-8
[4] Runqi Zhang, Yihong Chen, Calculus II. first edition, 2007. ISBN ISBN 978-7-111-18326-4
[5] James Stewart. Calculus: Early Transcendentals 6th ed. 2012. ISBN-13 978 – 0 – 538

100172205 Partial Differential Equations of Mathematical Physics and Special Functions

Lecture Hours: 32
Credits: 2.0
Prerequisite(s): Calculus, Complex function and integral transform

Course Description:
This course is to explore the problem of determining solutions to partial differential equations of mathematical physics. Primarily, three kinds of typical partial differential equations are introduced. Then we focus on several methods to solve problem of determining solutions to partial differential equations of mathematical physics such as method of traveling wave, method of separating variables, method of integral transform and method of Green's function. Finally, two special functions, Bessel function and Legendre polynomial, and their applications are presented.

Course Outcomes:
After completing this course, a student should be able to:
1. Know and comprehend basic knowledge of partial differential equations of mathematical physics.
2. Know and comprehend principles of different methods for solving problem of determining solutions to partial differential equations of mathematical physics.
3. Use suitable method to solve problems of determining solutions to partial differential equations of mathematical physics according to their features.
4. Know and comprehend concepts and properties of special functions and to solve some problems of determining solutions to partial differential equations of mathematical physics via special functions.

Course Content:

Lectures and Lecture Hours:
1. Derivation of partial differential equations of mathematical physics and problem of determining solution 3
   - Derivation of partial differential equations of mathematical physics
   - Conditions of determining solution and problem of determining solution
   - Classification and simplification of second order linear partial differential equations and superposition principle
2. Method of traveling wave 5
   - Cauchy problem of one-dimensional wave equations
   - Homogenized principle and Cauchy problem of nonlinear equations
   - Vibration of semi-infinite string
   - 2 and 3 dimensional wave equations
3. Method of separating variables 8
   - Free vibration of bounded string
   - Problem of heat conduction for bounded pole
   - Boundary value problem of Laplace equation in bounded domain
   - Problem of non-homogenous equations
   - Problem of non-homogenous boundary conditions
   - Sturm-Liouville problem
4. Method of integral transform 4
   - Concept and properties of Fourier transform
   - Applications of Fourier transform
   - Concept and properties of Laplace transform
   - Applications of Laplace transform
5. Method of Green's function 4
   - Boundary value problem of Laplace equation and basic solution

- Green's formulae and properties of harmonic function
- Method of Green's function
- Electric image method

6. Bessel function 5
   - Derivation and solving of Bessel equation
   - Recursion formulae of Bessel functions
   - Expanding a function in series of Bessel functions
   - Applications of Bessel functions
   - Other types of Bessel function and asymptotic formulae
7. Legendre polynomial 3
   - Introduction of Legendre equation
   - Solving of Legendre equation and Legendre polynomial
   - Differential expression of Legendre polynomials and asymptotic formulae
   - Expanding a function in series of Legendre polynomials
   - Associated Legendre polynomial

Grading:

Homework	20%
Final	80%

Text & Reference Book:

Text book:

G. Yan, Q. Zhang and H. Jiang, Partial Differential Equations of Mathematical Physics and Special Functions, 1st ed., 2013, ISBN 978-7-121-19879-3.

Reference books:

[1] Y. Wang, Partial Differential Equations of Mathematical Physics and Special Functions, 4th ed., 2012, ISBN 978-7-04-034764-7.
[2] K. Liang, Methods of Mathematical Physics, 4th ed., 2010, ISBN 978-7-04-028352-5.
[3] C. Gu, D. Li, S. Chen, S. Zhen and Y. Tan, Partial Differential Equations of Mathematical Physics, 2nd ed., 2002, ISBN 978-7-04-010701-2.
[4] L. Jiang, Y. Chen, X. Liu and F. Yi, Lectures on Partial Differential Equations of Mathematical Physics, 3rd ed., 2007, ISBN 978-7-04-020747-7.
[5] W. A. Strauss, Partial Differential Equations: An Introduction, 1st ed., 1992, ISBN 0-471-54868-5.

100180116/125 Physics Laboratory B I, II

Lecture Hours: 4
Laboratory Hours: 60
Credits: 2
Prerequisite(s): College Physics A Ⅰ, Ⅱ

Course Description:
This course is to learn the common measured data processing methods with the knowledge of uncertainty theory; master the common methods and operation techniques in physics laboratory, and the measure methods of basic physical parameters; know about the principles and applications of modern physics technologies and instruments which are widely used in current scientific research and engineering; understand the physical idea and experimental design in some classical physics laboratories.

Course Outcomes:
After completing this course, a student should be able to:
1. Process the measured data with the knowledge of uncertainty theory.
2. Master the common methods and operation techniques in physics laboratory, and measuring methods of basic physical parameters
3. Know the principles and applications of modern physics technologies and instruments.
4. Understand the physical idea and experimental design in some classical physics laboratories.

Course Content:
Lectures and Lecture Hours:

Introduction	4
- Uncertainty theory	
- Methods to process measured data	

Laboratories and Laboratory Hours:

1. Measurement of basic parameters of mechanics	4
2. Moment of inertia of a rigid body	4
3. Young's modulus of elasticity of metal	4
4. Measurement of sound velocity	4
5. Transmission by optical fiber	4
6. Harmonic vibration	4
7. Forced vibration	4
8. Collision on magnetic levitation guide rail	4
9. Measurement of relative pressure factor of atmosphere by sensor	4
10. Static character of granular matter	4
11. Millikan oil-drop experiment	4
12. Franck-Hertz experiment	4
13. Nuclear magnetic resonance	4
14. Set of thermal experiments	4
15. Oscilloscope	4
16. Double bridge experiments	4
17. Hall effect and measure of parameter	4
18. Magnetic properties of ferromagnetic material	4
19. Nonlinear circuits and chaos	4
20. Transient states in the RLC series circuit	4
21. Characteristics of solar panels	4
22. Measurement of geomagnetic field	4
23. Characteristics of giant magnetoresistance	4
24. Characteristics of magnetostriction	4
25. Fourier analysis of periodic electrical signal	4
26. Principle and design of digital multimeter	4

27. Focal length of thin lens and imaging	4
28. Interference of light	4
29. Measuring the refractive index using spectrometer	4
30. Refractive index determination of a medium by using total internal reflection	4
31. Michelson interferometer	4
32. Photoelectric effect and measurement of Planck constant	4
33. Holography experiment	4
34. Diffraction of light	4
35. Polarization of light	4
36. Design and assembly of telescope	4
37. Optical rotation and saccharimeter	4
38. Diffraction grating	4
39. Fabry-perot interferometer	4
40. Extension of depth of Field in holography	4
41. Electro-optic effect of crystal	4
42. Electro-optic characteristics of liquid crystal	4

Grading:
The final grade of one semester is the average of the grades of introduction homework and each laboratory.

Text & Reference Book:
Qingfan Shi, English-Chinese laboratory experiments in university physics, 2nd ed., 2010, ISBN 978-7-80248-067-4.

101190003 General Chemistry C

Lecture Hours: 32
Laboratory Hours: 0
Credits: 2
Prerequisite(s): high school chemistry

Course Description:
General Chemistry C is a basic course for students of non-chemical and chemical engineer majors. It aims to make the students know the universality and importance of chemical change, which can improve their knowledge and ability structure. It is essential for the development of a knowledgeable, competent, and highly qualified engineering science and technology talent.

Course Outcomes:
After completing this course, a student should be able to:
1. Master the basic principle of chemical reaction
2. Understand the basic structure of the materials
3. Analyze the relevant phenomena of the daylife in a chemical way

Course Content:
Lectures and Lecture Hours:

1. Introduction	1
2. The basic law of the chemistry reaction	10
- Basic concepts	
- Chemical reaction heat	
-Direction of chemical reaction	
- The degree of chemical reaction-- equilibrium of the reactions	
-Chemical reaction rate	
3. Solution and ion equilibrium (Self study)	
- Colligative properties of dilute solutions	
-Proton theory of acid base	
- Proton transfer equilibrium of acid base	
- Coordination equilibrium	
4. Redox reaction & electrochemistry	8
- Redox reaction	
- The original battery and the electric potential of the electrode	
- electrolysis	
- Corrosion and Protection of Metals	
5. Basic Structures of Matter	8
- Atomic structure and periodic system	
- Chemical bond	
-Intermolecular forces and hydrogen bonds	
- Structure of crystalline	
6. Metal materials	1
-Outline of metal	
-Several important metal elements and important compounds	
-Chemical and electrochemical processing of metallic materials	
7. Inorganic nonmetallic materials	1
- An overview of non-metallic elements	
- Important compounds of non-metallic elements	
- New inorganic nonmetal material	
8. Organic polymers and polymers	
-The basic concept of polymers	
- polymer materials	
9. Chemical and energy	1

- Fuel energy
- Electrochemical power source
- Novel energy

10. Chemistry and Life 1
- Surfactant
- Commonly used oil

11. Chemical and defense (Self study)
- Gunpowder
- Chemical weapons
- Nuclear weapon
- Modern weaponry and chemistry

12 Review lessons 2

Laboratories and Laboratory Hours: none

Grading:

Homework	20%
Final	80%

Text & Reference Book:

Qu Baozhong etc. New University Chemistry (Version 2)[M].Beijing：science press，2007.

100210045 Document Retrieval

Lecture hours: 0
Laboratory hours: 16
Credits: 1
Prerequisite(s): None

Course Description:
Document Retrieval is a common basic course, teaching the methodology of obtaining knowledge from literature resources with retrieval tools. The basic task of the course is to equip the students with fundamental theory and knowledge of document retrieval, familiarize the students with the knowledge and usage of various retrieval tools and computer retrieval systems. It aims to help the students understand the operation of modern libraries, how data is collated, how to use the data and resources, what information and service a library can provide; help the students to grasp the characteristics of network information, and grasp the skills to obtain information from networks.

100230057 Introduction to Intellectual Property Law

Lecture Hours: 16
Laboratory Hours: 0
Credits: 1
Prerequisite(s): None

Course Description:

This course provides the students not major in law the basic concepts, theories and systems of the copyright, patent, trademark and other intellectual property. The course forms a more reasonable knowledge structure and develops a strong awareness of intellectual property to the students. It equips the students with abilities to analyze and solve intellectual property problems, to protect their intellectual property rights and respect the intellectual property rights of others in their future study, work and life.

Course Outcomes:

After completing this course, a student should be able to:
1. Grasp the basic concepts, basic theories and basic system of intellectual property law.
2. Understand the history and role of intellectual property system in China.
3. Develop systematic awareness of intellectual property.
4. Create the ability to analyze and solve intellectual property problems.

Course Content:

Lectures and Lecture Hours:

1. Introduction 2
   Section I Occurrence of Intellectual Property System
   Section II Protection history of intellectual property in China
   Section III Development Trend of Intellectual Property System
   Section IV Basic Issues of Intellectual Property Law
2. Copyright Law 4
   Section I Object of Copyright
   Section II Subject of Copyright
   Section III Attribution of Copyright
   Section IV Copyright
   Section V Neighboring Rights
   Section VI Exercise and Limitation of Copyright
   Section VII Legal Protection of Copyright
3. Patent Law 3
   Section I Object of Patent
   Section II Subject of Patent
   Section III Patent Acquisition, Contents and Restrictions
   SectionIV Patent Application Reexamination and Patent Invalidation Declaration
   Section V Protection for Patent
   Section VI National Defense Patent
4. Trademark Law 3
   Section I Object of Trademark
   Second II Subject of Trademark
   Section III Acquisition and Loss of Trademark
   Section IV Trademark Restrictions and Exercise
   Section V Protection for Trademark Rights
   Section VI Protection for well-known trademarks
5. Other Intellectual Property 1
   Section I Integrated circuit layout design right
   Section II New plant variety rights

Section III Geographical Indication
Section IV Trade Name
Section V Trade Secrets
Section VI Domain

6. International Protection for Intellectual Property 1
   Section 1 Overview of International Protection of Intellectual Property
   Section II Paris Convention
   Section III Berne Convention
   Section IV Trade-Related Aspects of Intellectual Property Rights
7. Management and Application of Intellectual Property 1
   Section 1 Overview of the Management and Application of Intellectual Property
   Section II Intellectual Property Management in Enterprise
   Section 3 Main forms of intellectual property application

Grading:

Homework	10%
Inclass Quizzes	10%
Class Presentation	10%
Final	70%

Text & Reference Book:

曲三强：《现代知识产权法概论》（第三版），北京大学出版社 2015 版。
吴汉东．知识产权法（第三版），法律出版社 2009 年版．

100245101/102 College English

Lecture Hours: 128
Credits: 4.0

Course Description:
The syllabus is formulated on the "Guide to College English Teaching (Exposure Draft)" in 2015, issued by the Steering Committee of College Foreign Language Teaching in Colleges and Universities of Ministry of Education, and due consideration is given to the requirements of college English teaching reforms and development of our University. On the premise of ensuring the basic teaching requirements, the Undergraduate College English Education Unit can make appropriate adjustments to accommodating the actual situation. Teachers are allowed to add up and delete the contents in order to improve teaching efficiency and keep consistent with the teaching purposes and tasks of the whole school year in regular classes.
The syllabus will be practiced by all non-English major regular classes in BIT except for ESP students, Art students, Physical students and minority students. The main language of instructions of the course is English.

Course objectives:
After completing this course, students should be able to:
① Read common articles published in English newspapers; read professional relevant summaries, literatures or future job-related instructions and operating manuals; understand the main ideas, key information, textual structure and implications; apply fast reading skills and strategies in reading medium lengthy, difficult materials.
② Express personal viewpoints on general topics; write professional summaries and essays; describe a variety of charts; write introductions to future jobs and work functions, manuals of operations and products; produce commonly used written expressions with clear, coherent and complete ideas.
③ Translate familiar and future profession-related literatures of general difficulty; translate more formal and familiar articles with the help of a dictionary; produce correct, expressive and articulate language; apply translating skills in solving common problems.
④ Listen and comprehend everyday English conversations and announcements; understand familiar English radio and television programs of medium lengthy; grasp the main ideas and relevant details; understand the basic professional courses taught in English or related future-related verbal introductions of tasks and products; be better qualified in using listening skills.
⑤ Express personal views, feelings and opinions in English fluently on general topics; state facts, reasons and describe time and objects; elaborate, explain, compare and summarize familiar ideas, concepts and theories; apply verbal communicative skills in producing clear, correct and good organized English.

Course Content and Lecture Hours:

Course Content (First Semester)	Lecture Hours	Course Objectives Supported By
Unit 1 Social Media and Friendship	4	1、3、4、5
Unit 2 EQ and Charisma	4	1、3、4、5
Unit 3 Science and Methods	4	1、3、4、5
Unit 4 History and Memory	4	1、3、4、5
Unit 5 China and The World	4	1、3、4、5
Unit 6 Literature and Imagination	4	1、3、4、5
Unit 7 Humans and Nature	4	1、3、4、5
Unit 8 Chinese Tradition and Culture	4	1、3、4、5
Course Content (Second Semester)	**Lecture Hours**	**Course Objectives Supported By**
Unit 1 Philosophy and Thoughts	4	1、2、4、5
Unit 2 Art and Nature	4	1、2、4、5

Unit 3 Language and Communication	4	1、2、4、5
Unit 4 Kindness and Indifference	4	1、2、4、5
Unit 5 Business and Prosperity	4	1、2、4、5
Unit 6 Literacy and Technology	4	1、2、4、5
Unit 7 Law and Morality	4	1、2、4、5
Unit 8 Politics and Power	4	1、2、4、5

Assessment and Grading:

Class Performance and the Final Exam in the Proportion of the Total Score, the Method of Assessing Class performance.

Final Written:	50%
Final Listening & Oral:	20%
Coursework, Class Attendance:	30%

Text & Reference Book:

T S. Greenall, New Standard College English, ISBN 9787-5-600-7784-2.
Wang Shouren (editor), i English, ISBN 978-7-513-5752-8.

100245103/104 Cross-Cultural English Communication

Lecture Hours: 32+32
Laboratory Hours: 0
Credits: 2+2

Course Objectives:

After completing this course, a students should be able to:

- Have a view on why we should study cultures;
- Recognize the specific aspects of their own (Chinese) culture;
- Interact with someone from a different culture in an appropriate and non-offensive manner;
- Use the acknowledged observable components to analyze and classify a different culture;
- Identify culture phenomena which are different from their own, and examine and explain the roots of the culture behind the differences.

Course Content and Lecture Hours:

Course Content (First Semester)	Lecture Hours	Objectives Aimed at
Topic 1 ● Introduction of the teacher and teacher's home culture ● Introduction of the meaning of culture ● Discussing culture differences among regions of China	6	1, 2
Topic 2 ● Understanding many opportunities to interact cross-culturally ● Understanding how culture affects all aspects of interaction ● Understanding possible hardship of being immersed in a culture that seems foreign ● Understanding culture shock, culture stress	8	1, 3
Topic 3 ● Conversing appropriately with someone of another culture ● Being observant towards cultures different from your own ● Being a learner and teacher of culture in conversation	6	3, 4, 5
Topic 4 ● Understanding the building blocks of culture (concept of self, personal vs. societal responsibility, concept of time, locus of control) ● Analyzing/classifying Chinese culture's building blocks	8	1, 2, 4, 5
Topic 5 ● Understanding and recognizing direct and indirect communication styles in different cultures ● Practicing direct and indirect communication in different cultures	4	2, 3, 4, 5

Course Content (Second Semester)	Lecture Hours	Objectives Aimed at
Topic 6 ● Understanding and recognizing verbal and non-verbal communication ● Practicing verbal and non-verbal communication	4	2, 3, 4, 5
Topic 7 ● Understanding value differences in different cultures ● Recognizing their own values, on a personal and cultural level	8	1, 2, 3, 4, 5

● Thinking critically about differences in values		
Topic 8		
● Communicating accurately about common values	6	2, 3, 4, 5
● Exploring differences of value in conversation with others		
Topic 9		
● Understanding cross cultural classrooms and workplaces		
● Comparing workplace norms across cultures	8	1, 2, 3, 4, 5
● Understanding different concepts of power distance		
● Practicing workplace behaviors and dialogues		
Topic 10		
● Understanding the cross-cultural perspective	6	1, 2, 4, 5
● Analyzing the stages of cultural awareness		
Total	64	

Grading:

Quizzes/Assignments 40%
Class performance 20%
Final Exam 40%

Text & Reference Book:

1. Storti, Craig. *Figuring Foreigners Out: A Practical Guide.* Intercultural Press (1999).
2. Stringer, Donna and Cassiday, Patricia. *52 Activities for Improving Cross-Cultural Communication.* Intercultural Press (2009).
3. Snow, Don. *Encounters with Westerners: Improving Skills in English and Intercultural Communication.* Shanghai Foreign Language Publishers.

100320001-100320004 Physical Education I~IV

Lecture Hours: **36**
Laboratory Hours: **0**
Credits: **0.5 (2 in total)**
Prerequisite(s): **None**

Course Description:
Physical Education (PE) is one of the most important compulsory courses in college education. It is also an important standard to evaluate the quality of college education. The aim of PE is to enhance body quality and improve students' health and strengthen PE self-cultivation by reasonable physical and health education, and scientific physical training process. PE is an important component in the undergraduate curriculum system. PE incorporates body development, moral and ideological education, science and culture education, life and labor skill education, mind cultivation into various physical activities.
There are three types of PE.
1. PE I. It is the fundamental PE course in the first semester for freshmen.
2. PE for specific sport (PE II~IV). It is offered to students from their second semester to the sixth semester. It's named after the specific sport, such as PE for advanced volleyball, PE for aerobics, PE for boxing, and PE for health rehabilitation etc. The PE for health rehabilitation is for students who have abnormal physical condition, poor physical condition or serious diseases. Its aim is to restore their physical and mental health by learning, mastering, and practicing the basic knowledge of rehabilitation and sports therapy.
3. PE for sports training. It is a specialized program offered to students in the high-level sports teams of university to promote the enrollment of athletics and students with sport specialty.

Course Outcomes:
After completing this course, a student should be able to:
1. Have athletic skills and participate in sports. Students will master the basic methods and skills of physical exercise, can carry out sport exercise scientifically, and be able to participate and organize sports activities and competitions regularly.
2. Improve physical and mental health. Students will develop all kinds of physical fitness related to health in all aspects comprehensively, form healthy lifestyle, and improve psychological conditions by physical activities in order to meet the physical and psychological requirements of high quality education to ensure the normal study and work in university.
3. Master basic knowledge of PE and physical fitness. Students will study and master basic knowledge of PE, including basic theory of sport movements, the physical and biochemistry principles in sports, the evaluation methods of physical condition, and the competition rules of sports, as well as the treatment and rehabilitation methods of common sports injuries, health care methods, planning of physical fitness.

Course Content:
PE I is compulsory for all students in the first semester. Students can optionally select other three PE courses from the second to the sixth semester.
1 Fundamentals of PE 4
- Sports theory
- Sports injury and prevention
- Exercise planning
- Special technique and tactics theory
- Special projects
- Competition rules in sports

2 Physical quality exercises including training in endurance, strength, flexibility and special physical qualities in sports.
- Physical quality in PE I 16
- Physical quality in PE for specific sport 10

3 Techniques, tactics routines in sports. For competitive sports, the primary contents are techniques, tactics and training. For high level classes, the contents include training and competing in group and team. For none-competitive sports, it mainly contains routine and training to master routines proficiently.

- Techniques, tactics routines in sports in PE I 16
- Techniques, tactics routines in sports in PE for specific sport 22

Grading:

According to the character of various special sports, the evaluation contains general evaluation indicators and the special evaluation indicators reflecting the characteristics of the specific sport.

1. Theory examination up to 10%
   - Theory examination contains basic knowledge of PE, special sports techniques and regulations.
   - For none-competitive sport course, such as PE for Physical shape, Dance arrangement, Pentathlon, Physical comprehensive training, etc., examination contains basic knowledge of PE, arranging routine or compiling fitness plan.
2. Physical quality examination 30-50%
   - Basic endurance quality exam: testing of endurance qualities by running, standing long jump、pull up, and sit-ups.
   - Special physical quality exam: examinations are designed according to the characters and requirements of each special sport.
3. Special techniques, tactics examination 40-60%
   - PE I：examination of basic techniques.
   - PE for special sport: testing of abilities and skills compliant to the qualification criteria and level standards of each specific sport.
4. Attendance: attendance is compulsory. Absence, later arrival, and early leave are all counted as points penalty in the final score.

5.Rewardings

- Students who representing university participate in Beijing or National Student Sports Competitions, and complete PE class normally, are evaluated as excellent in final score.
- Students who participate in sport activities organized by institutes, according to scale and duration of the events, will get 2-5 points rewarding.

Text & Reference Book:

University Physical Education Course. 2010.Beijing Institute of Technology Press

101014003 Engineering Mechanics B

Lecture Hours: **64**
Laboratory Hours: **0**
Credits: **4**
Prerequisite(s): **None**

Course Description:
Engineering Mechanics B is a fundamental course for non-mechanical specialties. This course is intended to provide students with a clear and thorough picture of both the theory and application of the principles in theoretical mechanics and mechanics of materials. Theoretical mechanics includes three parts: statics, kinematics and kinetics. The first part - statics, introduces basic concepts and principles of statics, free-body diagrams, resultants and equilibrium of force system, etc. The second part - kinematics, covers kinematics of a point, translation and rotation of rigid bodies, composite motion of a point, and plane motion of rigid bodies. The third part - kinetics, introduces fundamental laws of kinematics and differential equations of a particle, the principle of impulse and momentum, the principle of work and kinetic energy, and D'Alembert's principle. Mechanics of materials deals with concepts of stress and train, mechanical properties of materials, the state of stress and strain for tension, compression, shear, torsion and bending, etc.

Course Outcomes:
At the end of this course, the students should be able to:
1. Perform equilibrium analyses of coplanar force systems to solve for unknown reactions in composite bodies.
2. Analyze the velocities and accelerations of a point or any point in a rigid body by composite motion of a point, theorem for projection of velocities, base point method and instantaneous center for velocities.
3. Perform the kinetic analyses of particles or rigid bodies by the principle of impulse and momentum, principle of work and kinetic energy, and D'Alembert's principle.
4. Solve statically indeterminate problems for axially loaded members.
5. Plot internal force diagrams for a beam in bending.
6. Perform stress or strain analyses and strength checks for members under combined deformation.

Course Content:
Lectures and Lecture Hours:
Theoretical Mechanics
Chapter 1 Principles of statics and the free-body diagram **2**
1.1 Fundamental concepts and statics
1.2 Principles of statics
1.3 Reactions of supports
1.4 Free-body diagram of a body
Chapter 2 Basic operations with force systems **2**
2.1 Reduction of concurrent force system
2.2 Moment of a force about a point
2.3 Moment of a force about an axis
2.4 Couples
Chapter 3 Reductions and resultants of force system **2**
3.1 Changing the line of action of a force
3.2 Reduction of a force system
3.3 Resultants of force systems
Chapter 4 Equilibrium of coplanar force systems **4**
4.1 Coplanar equilibrium equations
4.2 Equilibrium of composite bodies
4.3 Simple plane trusses

Chapter 5 Equilibrium of noncoplanar force systems 1

5.1 Supports for noncoplanar loads
5.2 Noncoplanar equilibrium equations
5.3 Center of gravity and centroid

Chapter 6 Friction 1

6.1 Dry friction
6.2 Theory of dry friction
6.3 Equilibrium problems involving friction
6.4 Angle of friction and phenomena of self-locking
6.5 Rolling resistance

Chapter 7 Kinematics of a point 1

7.1 Position, velocity and acceleration
7.2 Method of rectangular coordinates
7.3 Method of normal and tangential coordinates

Chapter 8 Translation and rotation of rigid bodies 1

8.1 Translation of a rigid body
8.2 Rotation of a rigid body about a fixed axis

Chapter 9 Composite motion of a point 4

9.1 Concepts of composite motion of a point
9.2 Composition of velocities of a point
9.3 Composition of accelerations of a point

Chapter 10 Plane motion of rigid bodies 4

10.1 Analysis of plane motion
10.2 Velocities of any point in a rigid body
10.3 Instantaneous center for velocities
10.4 Accelerations of any point in a rigid body

Chapter 11 Kinetics of a particle 1

11.1 Newton's laws of motion
11.2 Differential equations of motion of a particle

Chapter 12 Principle of linear impulse and momentum 2

12.1 Impulse and momentum
12.2 Principle of linear impulse and momentum
12.3 Motion of the mass center for a system of particles

Chapter 13 Principle of angular impulse and momentum 2

13.1 Angular impulse and angular momentum
13.2 Principle of angular impulse and momentum
13.3 Differential equations of rotation of a rigid body about a fixed axis
13.4 Mass moment of inertia
13.5 Differential equations of plane motion of a rigid body

Chapter 14 Principle of work and kinetics energy 2

14.1 Work done by forces
14.2 Kinetic energy
14.3 Principles of work and kinetic energy

Chapter 15 D'Alembert's principle 3

15.1 Inertial force and D'Alembert's principle of a particle
15.2 D'Alembert's principle of a system of particles
15.3 Reduction of a system of inertial forces of a rigid body

Mechanics of Materials

Chapter 1 Introduction 2

1.1 Study objects of Mechanics of Materials
1.2 Tasks of Mechanics of Materials
1.3 Basic assumptions of deformable bodies in Mechanics of Materials
1.4 Basic types of deformations of rods
1.5 Internal force and method of section
1.6 Concept of stress

Chapter 2 Axial tension and compression 6

2.1 Characteristics of the external force and deformation of axial tension and compression
2.2 Internal force in cross-section and inclined section of the rod in tension and compression
2.3 Stress in cross-section and inclined section of the rod in tension and compression
2.4 Mechanical properties of materials in axial tension and compression
2.5 Allowable stress, safety factor and strength condition
2.6 Deformation of the rod in axial tension and compression
2.7 Elastic strain energy of the rod in axial tension and compression
2.8 Statically indeterminate problem of the rod in axial tension and compression
2.9 Stress concentration
2.10 Shear and bearing

Chapter 3 Torsion **4**

3.1 External torque of a transmission shaft, internal torque and internal torque diagram
3.2 Torsion of the thin-walled hollow shafts
3.3 Stresses of circular shafts in torsion and strength conditions
3.4 Deformation of a circular shaft in torsion and rigidity conditions
3.5 Deformation of a rectangular shaft in torsion

Chapter 4 Geometric properties of plane areas **2**

4.1 Static moment and centroid
4.2 Moment of inertia and product of inertia
4.3 Parallel-axis theorem for moment of inertia

Chapter 5 Internal forces in bending **4**

5.1 Concepts of planar bending and calculation sketch of the beam
5.2 Internal forces in beam bending --- the shearing force and bending moment
5.3 The shearing-force and bending-moment equations · the shearing-force and bending-moment diagrams
5.4 Relations among the density of the distributed load, the shearing force and the bending moment and their applications

Chapter 6 Stresses in bending **4**

6.1 Normal stress on the cross section of the beam in planar bending
6.2 Shearing stress on the cross section of the beam in planar bending
6.3 Strength conditions of the beam in planar bending
6.4 Reasonable cross section of the beam

Chapter 7 Deformations in bending **2**

7.1 Deflection of the beam and rotational angle of the cross section
7.2 Approximate differential equation of the deflection curve of the beam
7.3 Determine the deformation of the beam by integration
7.4 Determine the deformation of the beam by the method of superposition
7.5 Rigidity condition of the beam
7.6 Simple statically indeterminate beams

Chapter 8 Stress state analysis and strength theories **6**

8.1 Concept of stress state
8.2 Plane stress state
8.3 Triaxial stress state
8.4 Strength theories

Chapter 9 Combined deformations **2**

9.1 Concepts of combined deformation
9.2 Combination of tension (compression) and bending
9.3 Combination of bending and torsion

Grading:

Homework	20%
Attendance	5%
Final Exam	75%

Text & Reference Book:

The following books are required for this course:

Luan Xifu, Zhang Tao and Zhao Chunxiang. Theoretical Mechanics 理论力学. 1st ed. 哈尔滨工业大学出版社, 2007.
Hibbeler RC. Mechanics of Materials (原书第六版) 材料力学. 武建华缩编, 1st ed. 重庆大学出版社, 2007.
These reference books are highly recommended:
Hibbeler RC. Engineering Mechanics (Statics), 10th ed. 高等教育出版社, 2004.
Hibbeler RC. Engineering Mechanics (Dynamics), 10th ed. 高等教育出版社, 2004.
Hibbeler RC. Mechanics of Materials, 5th ed. 高等教育出版社, 2004.

101031102 Engineering Graphics Fundamental

Lecture Hours: 32
Laboratory Hours: 8（after class as homework）
Credits: 2
Prerequisite(s): None

Course Description:

This course provides fundamental skills of the reading and writing, and the international and national standards on engineering drawing. The course focuses on presentation of 3-dimensional geometry on 2-dimensional media and the reading and writing of the working drawing.
The main contents are as follow:

1. Introduction to engineering design graphics, review of basic fabrication processes, international and national standards on engineering drawing, the fundamentals of orthographic projection with applications of 3-dimensional visualization and view writing, engineering sketching, geometric dimensioning and tolerance, drawing conventions and presentation of 3-dimensional geometry on 2-dimensional media, simplification of standard part or feature such as thread, gear and so on, and most importantly, working drawing including detail drawing and assembly drawing.
2. The use of 2-dimensional CAD software is briefly introduced in this course and homework can be done with drawing equipment or AUTOCAD.

Course Outcomes:

After accomplishing this course, students should:

1. Have the basic concept of mechanical design and representation and be familiar with the common mechanical structures and their fabrication processes.
2. Be familiar with freehand sketch for design concept communication.
3. Be expert in engineering drawing reading, can smoothly switch between the 1st and the 3rd projection system in drawing reading and writing, and have the fundamental skill of engineering drawing writing with drawing equipment and AUTOCAD software.
4. Demonstrate a thorough understanding of how to represent a part or an assembly with 2-dimentional views, conventions, auxiliary views and section views according its characteristic, which is the foundation of making working drawing with modelling software in the following spring semester.
5. Have a good knowledge in national and international drawing standards and understand how these standards and simplification of standard structure make the representation clearer.
6. Have the ability of dimensioning without repetition and omission; be familiar with the contents in detail drawing and assembly drawing.

Course Content:

Lectures and Lecture Hours:

1.	Introduction	2
2.	Brief on drawing standard	2
3.	Drawing equipment and usage, Instrumental Drawing	2
4.	Geometric Constructions	2
5.	Orthographic projection	2
6.	Orthographic writing	2
7.	Orthographic Reading exercise	2
8.	Dimensioning	2
9.	Orthographic Convention	2
10.	Auxiliary view and section	2
11.	Convention in section	2
12.	Thread Fastener	2
13.	Working Drawing -Detailed drawing	2

14.	Detailed drawing reading exercise	2
15.	Working Drawing -Assembly drawing	2
16.	Assembly drawing reading exercise	2

Laboratories and Laboratory Hours （after class as homework）:

1. On drawing standard and arc connection	2
2. On orthographic writing	2
3. On 2-dimentional representation	2
4. On detail drawing or assembly drawing	2

Grading:

Homework & Lab performance	20~30%
Final	80~70%

Text & Reference Book:

1. Cecil Jensen. JAY. Engineering Drawing & Design, 7th Edition. ISBN 978-0073521510 McGraw-Hill Higher Education, 2008
2. Giesecke, Frederick E, Mitchell, Alva. Technical Drawing, Twelfth Edition. ISBN 978-0130081834. Pearson Education, 2003.

101031314 Basic Training of Manufacturing Technology

Lecture Hours: **10**
Practice Hours: **50**
Credits: **2**
Prerequisite(s): **101037302**

Course Description:
This course is to explore mechanical manufacturing technique through lectures and basic trainings. Most of the modern manufacturing methods and typical machine tools will be introduced and used during the course. Basic equipment operating skills will be trained.

Course Outcomes:
After completing this course, a student should be able to:
1. Understand principles of modern manufacturing techniques;
2. Be familiar with applications of typical manufacturing equipment.
3. Select appropriate manufacturing methods and processes.
4. Operate typical equipment to produce normal mechanical parts.

Course Contents:
Lectures and Lecture Hours:

1. Introduction	1
- Metal casting	
- Forging	
- Welding	
2. Metal casting process forming methods and applications	1
- Precision casting	
- Foundry molding drawing	
- Applications of material methods	
3. Introduction of machining methods	1
- Turning	
- Milling	
- Grinding	
- Drilling	
4. Cutting tool materials	1
- High speed steel	
- Cemented carbide	
- Others	
5. Principles of milling	1
- Motions	
- Parameters	
- Process	
6. Gear profile machining	1
7. Benchwork	1
- Assembling	
- Tool making	
8. Hole making	1
- Drilling	
- Boring	
- Grinding	
9. Introduction of NC (Numerical control) machining	1
- NC turning	
- NC milling	
10. Rapid prototyping & manufacturing	1

Laboratories and Laboratory Hours:

1. Basic training of metal casting training;	10
2. Basic training of turning;	10
3. Basic training of milling;	10
4. Basic training of bench work;	10
5. Basic training of NC machining;	5
6. Basic training of 3D printing;	5

Grading:

Homework	10%
Project	90%

Text & Reference Book:

Manufacturing Engineering and Technology. Serope Kalpakjian, Steven Schmid. Prentice Hall, 6th Revised edition (2009-3)，ISBN 0136081681

101037302 Engineering Graphics

Lecture Hours: **56**
Laboratory Hours: **8**
Credits: **4**

Course Description:

This course provides fundamental skills of engineering drawing reading and writing, international and national standards on engineering drawing. The course focuses on presentation of 3-dimensional geometry on 2-dimensional media and working drawing reading and writing.
This course also provides fundamental skill of parametric design and working drawing representation with modelling software. The main purpose of this course is not modelling skill and the main focus is new design concept and representation technique including rendering and formal working drawing made with modelling software.

The main contents are as follow:

1. Introduction to engineering design graphics, review of basic fabrication processes, international and national standards on engineering drawing, the fundamentals of orthographic projection with applications of 3-dimensional visualization and view writing, engineering sketching, geometric dimensioning and tolerance, drawing conventions and presentation of 3-dimensional geometry on 2-dimensional media, simplification of standard part or feature such as thread, gear and so on, and most importantly, working drawing including detail drawing and assembly drawing.
2. The use of 2-dimensional CAD software is briefly introduced in this course and homework can be done with drawing equipment or AUTOCAD.
3. Introduction to the concept of parametric design, basic features such as extrusion, rotation, sweep and lofts. Situations when a working (sketch) plan is necessary and the methods of building a working plan. Constrains and sketching technique. Supplementary features such as rib, holes, thread, chamfer, fillets and so on.
4. Assembly construction and part modelling under assembly environment; Formal engineering drawing of parts; modify the representation of standard parts such as gears, spring, gears as defined in GB or ISO standard; the function and application of representation such as section view, auxiliary view, half section view, broken out section view and so on; besides working drawing, rendering part and assembly is also an effective way of representation.

Course Outcomes:

After accomplishing this course, students should:

1. Have the basic concept of mechanical design and representation and be familiar with the common mechanical structures and their fabrication processes.
2. Be familiar with freehand sketch for design concept communication.
3. Be expert in engineering drawing reading, can smoothly switch between the 1st and the 3rd projection system in drawing reading and writing, and have the fundamental skill of engineering drawing writing with drawing equipment and AUTOCAD software.
4. Demonstrate a thorough understanding of how to represent a part or an assembly with 2-dimentional views, conventions, auxiliary views and section views according its characteristic, which is the foundation of making working drawing with modelling software in the following spring semester.
5. Have a good knowledge in national and international drawing standards and understand how these standards and simplification of standard structure make the representation clearer.
6. Have the ability of dimensioning without repetition and omission; be familiar with the contents in detail drawing and assembly drawing.
7. Understand the basic concept of parametric design.
8. Be familiar with procedures of solids modelling and feature function of INVENTOR.
9. Be expert in engineering drawing representation using modelling software, knowing how to

adapt to corresponding method such as conventions, auxiliary views and section views according the characteristic of the part or assembly to be described.

10. Be expert in revising the representation and simplifying the automatic result of the software if it fails to meet the drawing standard.
11. Demonstrate a strong ability of mechanical design and making formal standard working drawing with modelling software.

Course Content:

Lectures and Lecture Hours:

1.	Introduction	2
2.	Brief on drawing standard	2
3.	Drawing equipment and usage, Instrumental Drawing	2
4.	Geometric Constructions	2
5.	Orthographic projection	2
6.	Orthographic writing	2
7.	Orthographic Reading exercise	2
8.	Dimensioning	2
9.	Orthographic Convention	2
10.	Auxiliary view and section	2
11.	Convention in section	2
12.	Thread Fastener	2
13.	Working Drawing -Detailed drawing	2
14.	Detailed drawing reading exercise	2
15.	Working Drawing -Assembly drawing	2
16.	Assembly drawing reading exercise	2
17.	Pictorial drawing and Free sketch	2
18.	Concept and procedure of parametric design, Sketching and Constraints	2
19.	Solids modelling, features.	4
20.	Supplementary sketching planes	2
21.	Duplicate features, Arrays and mirror	2
22.	Dimension and parameter transfer	2
23.	Part rendering	2
24.	Formal engineering drawing of parts	4
25.	Assemblies	2
26.	Part design under assembly environment	2
27.	Formal engineering drawing of assemblies	4
28.	Simplify of standard structure（Key, gears, bearing）	2
29.	Elementary Tolerances and dimension fitting in assembly drawing	2

Laboratories and Laboratory Hours:

1. On drawing standard and arc connection	2
2. On orthographic writing	2
3. On 2-dimentional representation	2
4. On detail drawing or assembly drawing	2

Additional more than 32 lab hours after class is necessary for modelling software practicing.

Grading:

Homework	20~30%
Midterm Exams	40~35%
Final	40~35%

Text & Reference Book:

1. Cecil Jensen. JAY. Engineering Drawing & Design, 7th Edition. ISBN 978-0073521510 McGraw-Hill Higher Education, 2008
2. Giesecke, Frederick E, Mitchell, Alva. Technical Drawing, Twelfth Edition. ISBN 978-0130081834. Pearson Education, 2003.

101037303 Research Methods and Academic Writing

Lecture Hours: 16
Credits: 1
Prerequisite(s): N/A

Course Description:
This course is to improve the students' ability in conducting research and academic writing, with emphases on research methodology, English usage in academic writing, conventions in mechanical engineering. The general research methods are introduced, as long as the reports needed in scientific and engineering research. Some typical sentence patterns will be introduced to enhance the quality of academic writing. Finally, the method of writing a technical article for publication in a technical journal will be introduced. Numerous samples of academic writing will be used and the students will be asked to practice extensively to fully use the methods that they have learned.

Course Outcomes:
After the students have taken this course, they are expected to:
1. Gain fundamental knowledge and experience in research, knowing the general research methodology and process of research.
2. Develop critical reading and writing skills, be able to think and write more clearly and incisively.
3. Have the ability to synthesize information from several sources into ones own writing, including use of sources and citation methods.
4. Develop the ability in academic writing
5. Be familiar with the structure and format of specific academic writing genres.

Course Content:
Lectures and Lecture Hours:

1. Introduction	2
2. Research methods and process	2
3. Topic selection and information searching	2
4. Writing your paper, Revising, and Editing	6
5. Grammar	4

Laboratories and Laboratory Hours: Not Applicable

Grading:

Quizzes and assignments	60%
Writing practices	40%

Text & Reference Book:
Reference Books:

1. M.L. Waddell, R.M. Each and R.R. Walker, The Art of Styling Sentences - 20 Patterns for Success, 3rd Edition, Barron's Educational Series, Inc., 1993. (Fourth Edition, 2002)
2. Judith S. Vanalstyne, Professional and Technical Writing: Communication in Technology and Science, Sixth Edition, Prentice-Hall International, Inc., 2004
3. Jose A. Carillo, English Plain and Simple, Second Updated Edition, Manila Time Publishing Corp., 2008.

101037305 Principle and Application of Engineering Materials

Lecture Hours: 40
Laboratory Hours: 8
Credits: 3
Prerequisite(s): 101180111, 101180121, 101190003

Course Description:
This course provides comprehensive knowledge and insight into the properties, structure and behaviour of engineering materials. The main materials discussed in this course are metal (ferrous and non-ferrous alloy), ceramics, polymers and composite. These special material structures and properties are studied in detail so that we can understand that how structure dictates properties and how processing can change structure. Furthermore, how to select the right material from the thousands that are available is discussed based on some criteria.

Course Outcomes:
After taking this course, students should:
1. Have an understanding of atomic and crystal structure and chemical bond types, and understand how these affect material properties.
2. Have an understanding of mechanical and thermal properties of materials and why a specific material is suited to particular applications.
3. Have an understanding of the unique characteristics of ceramics, polymers and metallic materials with an introduction to their engineering applications.
4. Have an understanding of and experience in testing material properties, with an emphasis on mechanical properties.
5. Have further developed their professional competence through working on group assignments; practicing written, oral and graphical communication skills; and using modern computer tools.

Course Content:
Lectures and Lecture Hours:

1. Introduction	1
2. Atomic Structure and Interatomic Bonding	2
- Primary and Secondary Interatomic Bonding	
- Bond Types and Materials Classification	
3. The Structure of Crystalline Solids	2
- Crystalline Structures	
- Crystallographic Points, Directions and Planes	
- Crystalline and Noncrystalline Materials	
4. Imperfections in Solids	2
- Crystalline Imperfections in Metals (Point Defects, Linear Defects, Planar Defects)	
- Various Strength Mechanisms (Solid Solution, Work Hardening, Fine Grains, etc.)	
5. Diffusion	2
- Mechanisms of Atomic Diffusion (Vacancy Diffusion, Interstitial Diffusion)	
- Factors that Influence Diffusion (Temperature, Activation Energy, Short-circuit Diffusion)	
6. Mechanical Properties of Metals	2
- Stress-Strain Behavior	
- Tensile Properties	
- Flexural Strength	

- Hardness

7. Dislocations and Strengthening Mechanisms 2
   - Plastic Deformation Mechanisms of Metals
     (Slipping, Twinning)
   - Mechanisms of Strengthening in Metals
     (Grain Size Reduction, Solid-Solution, Secondary Phases, Cold Working)
8. Failure 2
   - Fracture
   - Fatigue
   - Creep
9. Phase Diagrams 4
   - Phase, Microstructure
   - Phase Rule, Lever Rule
   - Binary-Alloy Phase Diagrams
   - Fe-Fe3C Phase Diagram
10. Phase Transformations in Metals 6
    - Heat Treatment of Steels
      (TTT Diagram, CCT Diagram)
    - Typical Heat Treatment Methods
      (Annealing, Normalizing, Quenching, Tempering, Spheroidizing, etc.)
11. Applications and Processing of Metal Alloys 4
    - Types of Metal Alloys
    - Fabrication of Metals
    - Thermal Processing of Metals
12. Ceramics 2
    - Ceramics Structures
    - Applications and Processing of Ceramics
13. Polymers 2
    - Polymer Structures
    - Mechanical Behaviour of Polymers
    - Polymer Types
14. Composites 2
    - Reinforcements
    - Matrix
15. Corrosion and Degradation of Materials 2
    - Corrosion
    - Degradation
16. Electrical, Thermal, Magnetic and Optical Properties 2
    - Low Thermal Expansion Alloys
    - Thermal Barrier Coatings (TBC)
    - Dielectric, Ferroelectric, Piezoelectric Materials
    - Soft, Hard Magnets
    - Optical Fibber, Laser
17. Economic, Environmental, and Societal Issues in Materials Science and Engineering 1
    - Economic Considerations
    - Environmental and Societal Considerations

Laboratories and Laboratory Hours:

1. Crystallography Experiment 2
2. Metallography 2
3. The effect of heat treatment on the microscopic structure and hardness 2
4. Unknown Polymer Identification 2

Grading:

Prerequisite quiz	3%
Homework	10%
Inclass Quizzes	5%
Group Presentation	5%
2 Midterm Exams	40%
Project	15%
Final	17%
Instructor Evaluation	5%

Text & Reference Book:

1. Materials Science and Engineering, An Introduction. William D. Callister, Jr. and David G. Rethwisch, John Wiley and Sons, Inc., SI Version, 2011.
2. Foundations of Materials Science and Engineering. Willian F. Smith, Javad Hashemi. Mc Graw-Hill, 5th edition, April 9, 2009.
3. Mechanical Engineering Materials. Shen Lian. China Machine Press, 3rd edition, 2007. (in Chinese) Recommended References

101037308 Machine Design Project

Lecture Hours: 3
Laboratory Hours: 2 weeks
Credits: 2
Prerequisite(s): 101037307

Course Description:

This is an advanced course on modelling, design, and integration of simple mechanical system. It also serves as a best practice for students to learn the way in which machine elements such as bearings, gears, shaft, bolts, cams and mechanisms are used. Modelling and analysis of these elements is based upon extensive application of core mechanical engineering principles. These principles are reinforced through a substantial design project wherein students model, design, fabricate and characterize a mechanical system that is relevant to a real-world application. The main goal of this course project is to practice the knowledge from the prerequisites mainly including the courses such as machine design etc., and to help students to successfully tackle genuine engineering problems encountered in practice.

Course Outcomes:

After completing this project, the student should be able to:
1. Practice the knowledge from the prerequisites mainly including the courses such as principle of machine and machine design
2. Master the complete design process of simple mechanical systems
3. Be familiar with usage of mechanical design handbook
4. Know well mechanism synthesis, kinematic and dynamic analysis
5. Know well the design process of typical mechanical elements.
6. Know well the application of tolerances limits and fits
7. Help students to successfully tackle genuine engineering problems encountered in practice

Course Content:

The project is to create a structure from a concept; the typical mechanical system may be the reducer, but is not limited to this. The students are requested to fulfil the following design work in due time
1. Mechanism synthesis;
2. Kinematic and dynamic analysis;
3. Designing or selecting the gears, shafts, and bearing, etc, with detailed analysis;
4. Assemble designed components with reasonable considerations;
5. Give reasonable dimensions and tolerances limits and fits in assembly drawing and part drawings;
6. Complete engineering drawing including assembly and part drawings;
7. Design report.

Laboratories and Laboratory Hours:

1. Reducer assembly	2

Grading:

On-time step due	10%
Structure design, drawing	50%
Design analysis	20%
Report writing	20%

101037326/101050204/101062101 Introduction to Engineering

Lecture Hours: **16**
Laboratory Hours: **0**
Credits: **1**
Prerequisite(s):None

Course Description:

This is an introductory course for engineering students to understand the fundamentals of engineering. The whole instruction activity is organized to help engineering students in:

1. forming a global engineering mind-set, so that they understand the engineering process and to best practice on solving engineering problems and designing products, no matter what industries they are in;
2. gaining hands-on experiences by directly working with international senior engineers, so that they learn from the real world to solve meaningful problems and design meaningful products.

The course is a team-taught course with the following primary objectives:

1. To foster engineering mindset for engineering students as a basic skill to solve engineering problems;
2. To introduce students to basic engineering design concept, principle, methodology, best practice, and engineering process;
3. To assist students in acquiring skills for identifying, formulating, and solving real world engineering problems;
4. To equip students with the knowledge of engineering sustainability and the mindset of sustainable engineering design;
5. To expose students to real world product development process and popular engineering tools;
6. To promote global perspective for engineering students as a basic skill to design products for global market;
7. To give students contextualized instruction and experience in technical communication.

Course Outcomes:

Upon successful completion of this course, students shall be able to

1. Understand the basic concepts of global engineering principle, methodology, sustainability, best practice, and global engineering process.
2. Form a real-world engineering mind-set (which alters student's traditional thought about product design)
3. Identify, formulate, and solve a real-world engineering problem
4. Create a reasonable product design proposal with a simple prototype to meet customer needs in functional and non-functional requirements and within simple constraints such as economic, environmental, social, and sustainability
5. Use a popular global engineering tool (CAD) for engineering design
6. Function in a teamwork environment
7. Understand engineering ethical responsibility
8. Communicate effectively
9. Understand the impact of engineering solutions in a global context.

Course Content:

Lectures and Lecture Hours:

Unit 1: Engineering Overview
  1.1 Globalization and Engineering
  1.2 Engineering Functions
  1.3 Engineering Disciplines
Unit 2: Engineering Process
  2.1 Engineering Process Overview
  2.2 Problem Identification

2.3 Research Phase
2.4 Requirements Specification
2.5 Concept Generation & Selection
2.6 Systems Design
2.7 Prototyping
2.8 System Integration and Maintenance
2.9 Iteration

Unit 3: Engineering Best Practices
3.1 Design Methods
3.2 Solid Modeling
3.3 Rapid Prototyping
3.4 Advanced Manufacturing
3.5 Enabling Technology
3.6 Project Management

Unit 4: Engineering Sustainability
4.1 Traditional Engineering vs. Sustainable Engineering
4.2 Introduction to Engineering Sustainability
4.3 Green Engineering
4.4 Sustainable Engineering Design

Grading:

Classroom Participations/Responses:	20%
Project:	50%
Final Exam:	30%

Text & Reference Book:

The course is mostly about real-world engineering experience, therefore, there are no textbooks needed. Students will leverage Internet contents for project assignments.

101051238 Electrical & Electronics I

Lecture Hours: 40
Laboratory Hours: 16
Credits: 2.5
Term(If necessary): Sophomore
Prerequisite(s): Calculus A, Physics

Course Description:
The course introduces electric circuits for non-major in electrical engineering. It covers circuit analysis and analog circuit analysis. The content and topic of this course are designed explicitly to meet the needs of the non-majors and are relevant to their major area of study.

Course Outcomes:
After completing this course, a student should be able to:
1. Develop theoretical and experimental skills and experiences in basic circuit analysis and measurement, first-order transient, steady-state ac circuits analysis, diode circuits, electronic amplifiers and operational amplifiers.
2. Analyze ac and dc circuits and determine the theoretical value for current, voltage, power and resistance (impedance) in ac and dc series and parallels circuits applying Ohm's law, Kirchholf's voltage and current laws, Thevenin equivalent method.
3. Analyze and design basic diode, transistor and operational amplifier circuits.
4. Apply basic electronics to industrial applications.

Course Content:
Lectures and Lecture Hours:

1. Introduction 4
   - Circuits, Currents, and Voltages
   - Power and Energy
   - Kirchholf's Laws
   - Introduction to Circuit Elements
   - Introduction to Circuits
2. Resistive Circuits 8
   - Resistance in series and parallel
   - Network analysis by using series and parallel equivalents
   - Voltage-divider and current-divider circuits
   - Node-voltage analysis
   - Thevenin and Norton equivalent circuits
   - Superposition principle
3. Inductance and Capacitance 1
   - Capacitance
   - Physical characteristics of capacitance
   - Inductance
   - Practical inductance
4. Transients 4
   - First-order RC circuits
   - DC steady state
   - RL circuit
5. Steady-state sinusoidal analysis 6

- Sinusoidal Currents and Voltages
- Phasors
- Complex Impedances
- Circuit Analysis with Phasors and Complex Impedances
- Power in AC Circuits
- Balanced Three-Phase Circuits

6. Frequency response and resonance 2

- Fourier Analysis, Filters, and Transfer Functions
- First-Order Lowpass/Highpass Filters
- Series Resonance
- Parallel Resonance

7. Diodes 3

- Basic Diode Concepts（
- Load-Line Analysis of Diode Circuits
- Zener-Diode Model
- Rectifier Circuits
- Wave-Shaping Circuits

8. Amplifiers: specifications and external characteristics 2

- Basic Amplifier Concepts
- Power Supplies and Efficiency
- Additional Amplifier Models
- Ideal Amplifier
- Frequency Response
- Linear Waveform Distortion
- Differential Amplifier

9. Bipolar junction transistors 4

- Current and Voltage Relationships
- Common-Emitter Characteristics
- Load-Line Analysis of Common-Emitter Amplifier
- PNP Bipolar Junction Transistors
- Small-Signal Equivalent Circuits
- Common-Emitter Amplifier
- Emitter Followers

10. Operational amplifiers 6

- Ideal Operational Amplifiers
- Inverting Amplifiers
- Noninverting Amplifiers
- Design of Simple Amplifiers
- Op-amp Imperfections in the Linear Range of Operation
- Nonlinear Limitations
- DC Imperfections
- Differential and Instrumentation Amplifiers

- Integrators and Differentiators
- Active Filters

Laboratories and Laboratory Hours:
See 101051295 'Experiment for Electrical & Electronics (I)'
Grading:

Homework	15%
Project	10%
Final	70%
Instructor Evaluation	5%

Text & Reference Book:
Allan R. Hambley, Electrical Engineering: Principles and Applications, 6^{th} ed., 2014, ISBN 978-0-13-311664-9

101051239 Electrical & Electronics II

Lecture Hours: 40
Laboratory Hours: 16
Credits: 2.5
Term(If necessary): Sophomore
Prerequisite(s): Calculus A, Physics

Course Description:
The course introduces electric circuits for non-major in electrical engineering. It covers digital circuit analysis, motors, transformers, elementary controlling circuits. The content and topic of this course are designed explicitly to meet the needs of the non-majors and are relevant to their major area of study.

Course Outcomes:
After completing this course, a student should be able to:
1. Develop theoretical and experimental skills and experiences in digital circuit analysis, electromechanical engineering and electrical controlling.
2. Analyze basic combinational and sequential logic circuit
3. Analyze and understand basic ac motor design.
4. Apply basic controlling circuit to industrial applications.

Course Content:
Lectures and Lecture Hours:

1. Logic Circuits 16
   - Basic Logical Circuits Concepts
   - Representation of Numerical Data in Binary Form
   - Combinatorial Logic Circuits
   - Synthesis of Logic Circuits
   - Minimization of Logic Circuits
   - Sequential Logic Circuits
2. Magnetic Circuits and Transformers 6
   - Magnetic Fields
   - Magnetic Circuits
   - Inductance and Mutual Inductance
   - Magnetic Materials
   - Ideal Transformers
   - Real Transformers
3. AC Machines 6
   - Three-Phase Induction Motors
   - Equivalent-Circuit and Performance Calculations for Induction
   - Synchronous Machines
   - Single-Phase Motors
   - Stepper Motors and Brushless DC Motors
4. Motor Electrical Control 6
   - Low-voltage Apparatus
   - Introduction to the Typical Control Principles & Circuits
   - Introduction to the General Design Principles

5. The Basic Principles and Applications of PLC 6

- Introduction
- The Basic Framework and Operating principles
- Data Types and Addressing modes of S7-200 CPU
- Basic Instructions of S7-200
- Application Examples

Laboratories and Laboratory Hours:
See 101051296 'Experiment for Electrical & Electronics (II)'

Grading:

Homework	15%
Project	10%
Final	70%
Instructor Evaluation	5%

Text & Reference Book:
Allan R. Hambley, Electrical Engineering: Principles and Applications, 6^{th} ed., 2014, ISBN 978-0-13-311664-9

101051295 Electrical & Electronics Lab I

Lecture Hours: 0
Laboratory Hours:16
Credits: 0.5
Term(If necessary): Sophomore
Prerequisite(s): Calculus A, Physics

Course Description:
The course introduces electric circuits for non-major in electrical engineering. It covers circuit analysis, and analog circuit analysis. The content and topic of this course are designed explicitly to meet the needs of the non-majors and are relevant to their major area of study.

Course Outcomes:
After completing this course, a student should be able to:
1. Develop theoretical and experimental skills and experiences in basic circuit analysis and measurement, first-order transient, steady-state ac circuits analysis, diode circuits, electronic amplifiers and operational amplifiers.
2. Analyze ac and dc circuits and determine the theoretical value for current, voltage, power and resistance (impedance) in ac and dc series and parallels circuits applying Ohm's law, Kirchholf's voltage and current laws, Thevenin equivalent method.
3. Analyze and design basic diode, transistor and operational amplifier circuits.
4. Apply basic electronics to industrial applications.

Course Content:
Laboratories and Laboratory Hours:

1.	Electrical measurement	2
2.	Research on RLC circuits	2
3.	Research on RC circuit's transient response	2
4.	Single-phase AC circuits and power factor improvement	2
5.	Research on three-phase AC circuits	2
6.	Research on single-stage amplifier	2
7.	The basic applications of op-amp（1）	2
8.	The basic applications of op-amp（2）	2

Lectures and Lecture Hours:
See 101051238 'Electrical & Electronics (I)'

Grading:

Attendance	20%
Skills	20%
Experiment	25%
Final	30%
Instructor Evaluation	5%

Text & Reference Book:
Allan R. Hambley, Electrical Engineering: Principles and Applications, 6th ed., 2014, ISBN 978-0-13-311664-9

101051296 Electrical & Electronics Lab II

Lecture Hours: 0
Laboratory Hours: 16
Credits: 0.5
Term(If necessary): Sophomore
Prerequisite(s): Calculus A, Physics

Course Description:
The course introduces electric circuits for non-major in electrical engineering. It covers digital circuit analysis, motors, transformers, elementary controlling circuits. The content and topic of this course are designed explicitly to meet the needs of the non-majors and are relevant to their major area of study.

Course Outcomes:
After completing this course, a student should be able to:
1. Develop theoretical and experimental skills and experiences in digital circuit analysis, electromechanical engineering and electrical controlling.
2. Analyze and troubleshoot the basic combinational and sequential logic circuit
3. Analyze and understand basic ac motor design.
4. Apply basic controlling circuit to industrial applications.

Course Content:
Lab works and Lab Hours:

1. Research on the rectifier, filter and voltage regulator circuit	2
2. The design of combination logic circuits	2
3. The design of sequential logic circuits	2
4. The application of transformer	2
5. Relay-contactor control systems (1)	2
6. Relay-contactor control systems (2)	2
7. S7-200 PLC basic experiment (1)	2
8. S7-200 PLC basic experiment (2)	2

Lectures and Lecture Hours:
See 101051239 'Electrical & Electronics (II)'

Grading:

Attendance	20%
Skills	20%
Experiment	25%
Lab report	30%
Instructor Evaluation	5%

Text & Reference Book:
Allan R. Hambley, Electrical Engineering: Principles and Applications, 6th ed., 2014, ISBN 978-0-13-311664-9

101062102 Electric Circuit Experiment

Lecture Hours: 0
Laboratory Hours: 16
Credits: 1
Term: The second term of freshman year
Prerequisite(s): Mathematical Analysis for Engineering, Physics

Course Description:
This course is one of the most important experiment courses of Electrical Specialty in colleges and universities. Students are required to grasp the necessary basic knowledge of circuit analysis when learning this course. The primary content of the "circuit experiments" includes analysis of the circuit, exploring and verifying the basic laws as well as analysis methods of electric circuit, it has a broad background of engineering. And it plays a significant role in establishing a rigorous scientific attitude and engineering viewpoint of applying theory to reality. It simultaneously does good to develop scientific thinking skills and capacity of experimental research and scientific induction. Furthermore, through the curriculum, we will reach to the purpose that students could deepen the understanding of essential theoretical knowledge as well as measurement and analysis methods of circuit while they could master the basic skills of circuit experiment.
Course Outcomes:
After completing this course, a student should be able to:
1. Master the basic experimental operation skill and use of common instruments.
2. Grasp the basic method of simple circuits design, analyze and eliminate simple circuits faults independently.
3. Deeply understand the circuit theory through analyzing the circuit experiment phenomenon.
4. Improve the ability to analyze and solve problems and build a realistic, rigorous scientific attitude and good experimental habits.
5. Master the simulation of software (Multisim) in the circuit experiment and the operate of the software.

Course Content:
Laboratories and Laboratory Hours:
(Hardware)
1. The instructions of the instruments and measurement of the volt-ampere characteristics of fundamental components. 2
2. Study on the response of First-Order dynamic RC circuit. 2
3. Study on the response of First-Order dynamic series RLC circuit. 2
4. Study on the switching characteristic and controlled current sources characteristic of the transistor. 2
5. Study on the responses of Operational Amplifiers. 2

(Software)
1. Verification of Thevenin theorem. 1
2. Verification of superposition principle. 1
3. Responses of First-Order dynamic RC circuit. 1
4. Responses of Second-Order dynamic RLC Circuits. 1
5. Switching characteristic and controlled current sources characteristic of the transistor. 1
6. Responses of Operational Amplifiers. 1

Grading:

Preview	20%
Operation	50%
Report	30%

Text & Reference Book:
Charles K.Alexander, Fundamentals of Electric Circuit, 3rd ed., 2008, ISBN 9787302180104.
Li Hansun, Fundamentals of Circuit Analysis, 4th ed., 2006, ISBN 9787040184709.

101063107 Digital Logic Circuit and CPU

Lecture Hours: 54
Laboratory Hours: 16
Credits: 4
Prerequisite(s):
Students should be familiar with Kirchoff's laws, analysis of basic electrical and electronic circuits.

Course Description:
This course covers principles of binary numbers, digital systems, assembly language programming, and gives an overview of computer architecture. It provides a background in basic technology areas that are required to understand computer architecture and design.

Course Outcomes:
After successfully completing the course, the students will be able to
1. analyze and design combinational logic circuits
2. analyze and design sequential logic circuits
3. develop and simulate gate-level models of digital logic circuits
4. do Assembly language programming
5. understand the computer structure and design.

Course Content:
Lectures and Lecture Hours:

1. Introduction, History of Computing	**1**
2. Binary, Hexadecimal, and Decimal Numbers	**4**
- The Computer Number System	
- Binary Numeric Representation	
- Converting Binary-Hexadecimal	
- Integer Binary/Decimal Conversions	
- Converting Decimal Fractions - Binary Fractions	
3.Signed Binary Numbers and Binary Codes	**4**
- Binary Sign Representations	
- Finding Two's Complements	
- Converting Two's Complement Binary- Decimal	
- Two's Complement Binary Math	
- ASCII Code	
4. Boolean Algebra and Combinational Digital Logic	**8**
- Boolean Algebra in the Computer	
- Truth Tables	
- Creating Boolean Functions	
- SOP and POS Boolean Representations	
- Using a Truth Table to Find Boolean Expressions	
- Step-by-Step Logic Circuit Design	
5. Logic Simplification Using Karnaugh Maps	**8**
- Simplifying Logic Circuits	
- Karnaugh Maps	
- Three-Variable Karnaugh Map	
- Four Variable Karnaugh Map	
- Karnaugh Map Terminology	

- Logic Simplification

6. More Complex Combinational Logic Circuits 4

- Exclusive OR/Exclusive NOR (XOR/XNOR)
- Quick Simplification Review
- Decoders
- Definition of a Multiplexer
- Differences in Decoder and Multiplexer
- Principles of Addition
- A "Half-Adder" Circuit
- The "Full Adder"
- Subtraction
- The ALU or "Datapath"

7. Flip-Flops, The Foundation of Sequential Logic 4

- The Simple R-S Flip-Flop
- Flip-Flops and "Memory"
- Clocked Circuits
- Clocked Flip-Flops
- The D Flip-Flop
- Timing Diagrams
- The Master-Slave D Flip-Flop
- The J-K Master-Slave Flip-Flop

9.Registers, Counters, and Other Latch-Based Circuits 8

- The Data Bus
- The Concept of Data "Gating"
- Gating Data Into a Storage Register
- Shift Registers
- Serial/Parallel Register Timing
- Parallel-to-Serial Shift Register
- A Simple Binary Counting Circuit
- Synchronous Binary Counter
- Generalized Mod-2n Counter

10.Designing Digital Sequential Logic Circuits 4

- Designing Sequential Logic
- A Signal Generator
- Designing the Timer
- A "Sequential" Multiplexer

11. Design of the ALU and Datapath 8

- The ALU and Datapath
- The MIPS Computer: An Example of "Bit-Slicing"
- ALU Components
- Program Counter Architecture
- More ALU Components – Data Memory
- The Sign Extender
- Data Bus Connection in a Load Instruction
- Data Bus Connection in a Store Instruction
- Branch Instructions

- Jump ALU Path
- Combining the Elements to Make a Complete ALU
- The "Single Cycle" ALU

12. Design of the ALU and Datapath **8**

- The ALU and Datapath
- The MIPS Computer: An Example of "Bit-Slicing"
- ALU Components
- Program Counter Architecture
- More ALU Components – Data Memory
- The Sign Extender
- Data Bus Connection in a Load Instruction
- Data Bus Connection in a Store Instruction
- Branch Instructions
- Jump ALU Path
- Combining the Elements to Make a Complete ALU
- The "Single Cycle" ALU

Laboratories and Laboratory Hours:

1. Familiarization with Lab Equipment and Basic Logic Functions
2. Basic combinational logic
3. Build the RS and clocked D flip-flop circuits in the lab
4. Design an 8-bit adder
5. Design a more sophisticated assembly language loop program and in program debug and refinement.
6. Move a step up in sophistication by designing a program with a recursive loop

Grading:

Homework	5%
Class Attendance	5%
Experiment	20%
Final Exams	70%

Text & Reference Book:

Textbooks: Digital Fundamentals (10th Edition),Thomas L. Floyd , 2016
The Intel Microprocessors--from 8086 to Pentium Architecture, Programming and Interfacing(Fifth Edition) Barry B. Brey

101080081 Computer Science and Programming

Lecture Hours: 32
Laboratory Hours: 16
Credits: 3
Prerequisite(s): None

Course Description:
This course introduces the basic concepts of computer science and the art of C programming. The students will learn how to think algorithmically and solve problems efficiently. Topics include: computer systems, data representation, programming basics, algorithms, data structures, software engineering, control flows, functions and program structures, pointers and arrays, structures, and file manipulations. Visual C/C++ or any other Integrated Development Environment will be used throughout the course. Extensive programming exercises will be given to ensure proficiency with C. All assignments will be submitted through a Moodle-based CMS system.

Course Outcomes:
After completing this course, a student should be able to:
1. Explain how a modern computer works.
2. Understand the basic terminology used in computer programming.
3. Write, compile and debug programs in C language.
4. Use different data types in a computer program.
5. Design programs involving decision structures, loops and functions.
6. Explain the difference between call by value and call by reference
7. Understand the dynamics of memory by the use of pointers.
8. Use different data structures and create/update basic data files.
9. Design C programs to solve moderately complicated problems.

Course Content:
Lectures and Lecture Hours:
1. Introduction to Computer Science 6
   - concepts of computers and von Neumann model
   - data representations
   - system development life cycle
   - programming process
2. Types, operators and expressions 4
   - data types
   - constants and variables
   - operators
3. Flow of control 6
   - conditionals
   - loops
   - transfer statements
4. Functions and program structures 4
   - functions
   - storage classes
   - C preprocessors
   - recursions and iterations
5. Pointers and arrays 6
   - call by value and call by reference
   - arrays
   - pointers
6. Structures 4
   - structures

- arrays of structures
- linked lists

7. Files 2
    - standard I/O
    - file access functions

Laboratories and Laboratory Hours:

Lab1: “newbie” level programming exercises (2-3)*
Lab2: “novice” level programming exercises(3)
Lab3: “amateur” level programming exercises(3)
Lab4: “apprentice” level programming exercises(3)
Lab5: “trained” level programming exercises(2)
Lab6: “skilled” level programming exercises(2)
Lab7: “veteran” level programming exercises(2)
Lab8: “expert” level programming exercises(2)

Note: The number in the parenthesis indicates the number of programming exercises in the set. Each lab session lasts for 2 hour. The students are also supposed to work on the programming exercises after class/lab.

Grading:

Programming exercises	50%
Final	50%

Text & Reference Book:

Behrouz A.Forouzan，Computer Science-a structured programming approach using C（计算机科学引论-基于 C 的结构化程序设计方法(英文版.第 3 版)）, 2007, ISBN：9787111214021.

101080082 C Programming Practice

Lecture Hours: 16
Credits: 1
Prerequisite(s): Computer Science and Programming

Course Description:
In this course, the students will work in a group of 3-6, simulating a software development team as in real settings. Each team will decide the topic of the project, and solve real problems along the way. Supervisors are available for supports and feedback. A gamified approach will be taken and game metaphors (such as quests and experience points) will be used throughout the course. This is a "flipped" course, meaning that most of the learning will happen AFTER class. Class time will be used for student presentations, discussions and problem solving. All assignments will be submitted through a Moodle-based CMS system.

Course Outcomes:
After completing this course, a student should be able to:
1. Develop and sustain effective teamwork as in real settings;
2. Communicate effectively to solve real problems;
3. Manage software projects;
4. Learn how to write and present in different media such as project documents and presentation videos;
5. Design and create a complicated software system, such as a Video game;
6. Promote and release a final product.

Course Content:
Lectures and Lecture Hours:

1. Introduction and team formation 4
   - detailed descriptions of the course
   - form teams of 3-6
   - create team intro video
   - write project documents version 1.0
2. Software engineering and status report 4
   - software development processes
   - how to write technical documents
   - status report
   - write project documents version 2.0
3. Technical reports 4
   - present program framework, key data structures and key algorithms
   - status report (stressing UI design)
   - write project documents version 3.0
4. Final release 4
   - final release video
   - project summary
   - peer evaluation and feedback
   - write project documents version 4.0

Grading:

First week assignments	about 20%
Second week assignments	about 20%
Third week assignments	about 20%
Final week assignments	about 40%

Text & Reference Book: N/A

101180111 College Physics I

Lecture Hours: 64
Laboratory Hours: 0
Credits: 4
Prerequisite(s):
Mathematics preparation at least one semester of calculus is required. However, some elementary ideas and skills from multivariable and vector calculus are used and students are encouraged to take Applied Mathematics concurrently.

Course Description:
This course is the first half of a one-year introduction to physics. It satisfies the requirements for a standard introductory physics course for scientists and engineers, and focuses on development of scientific reasoning and problem-solving skills. The course material covers a wide range of topics with a clear and logical presentation of the basic concepts and principles of physics. The topics include: kinematics; linear and rotational motion; Newton's dynamics of motion; conservation of momentum and energy; kinetic theory of gases; thermodynamics; oscillations and waves; and wave optics. Multivariable and vector calculus is used extensively in the course. There are no separate labs or discussion sections.

Course Outcomes:
After completing this course, a student should be able to:
1. Understand the fundamental concepts and laws of physics.
2. Promote self-directed study of basic physics, explore physics in the context of real-world applications.
3. Make use of scientific method: Observation and Reduction-Modeling-Theory and Law-Application.

Course Content:
Lectures and Lecture Hours:
1. Introduction, Measurement, Estimating 2
    - Measurement and Uncertainty; Significant Figures
    - Units, Standards, and the SI System, Converting Units
    - Order of Magnitude: Rapid Estimating
    - Dimensions and Dimensional Analysis
2. Describing Motion: Kinematics in one dimension 2
    - Reference Frames and Displacement
    - Average Velocity
    - Instantaneous Velocity
    - Acceleration
    - Motion at Constant Acceleration
    - Falling Objects
    - Solving Problems
    - Use of Calculus; Variable Acceleration
3. Kinematics in two dimensions; Vectors 2
    - Vectors and Scalars
    - Addition of Vectors – Graphical Methods
    - Subtraction of Vectors, and Multiplication of a Vector by a Scalar
    - Adding Vectors by Components
    - Unit Vectors
    - Vector Kinematics
    - Projectile motion
    - Solving Problems Involving Projectile Motion
    - Uniform Circular Motion
    - Relative Motion

General Basic Courses

4. Dynamics: Newton's Laws of Motion 2
    - Summary of Newton's Laws
    - Some Particular Forces
    - Dynamics in Noninertial Frame
    - Applying Newton's Laws
5. Further Applications of Newton's Laws 2
    - Friction Force
    - Uniform Circular Motion
    - Highway Curves, Banked and Unbanked
    - Nonuniform Circular Motion
    - Velocity-Dependent Forces; Terminal Velocity
6. Work and Energy 2
    - Work and Power
    - Kinetic Energy and the Work-Energy Principle
    - Conservative and Nonconservative Forces
    - Potential Energy
7. Conservation of Energy 2
    - Mechanical Energy and Its Conservation
    - Problem Solving Using Conservation of Mechanical Energy
    - The Law of Conservation of Energy
    - Energy Conservation with Dissipative Forces
    - Gravitational Potential Energy and Escape Velocity
    - Potential Energy Diagrams
8. Linear Momentum and Collisions 2
    - Momentum and Its Relation to Force
    - Conservation of Momentum
    - Collision and Impulse
    - Conservation of Energy and Momentum in Collision
    - Elastic Collisions in One Dimension
    - Inelastic Collisions
    - Collisions in Two or Three Dimensions
    - Center of Mass
    - Center of Mass and Translational Motion
    - Systems of Variable Mass: Rocket Propulsion
9. Rotational Motion about a Fixed Axis (I) 2
    - Angular Quantities
    - Kinematics Equations for Uniformly Accelerated Rotational Motion
    - Rolling Motion without Slipping
    - Vector Nature of Angular Quantities
    - Torque
    - Torque and Rotational Inertia
    - Solving Problems in Rotational Dynamics
    - Determine Moments of Inertia
10. Rotational Motion about a Fixed Axis (II) 3
    - Angular Momentum and Its Conservation
    - Rotational Kinetic Energy
    - Rolling: Rotational + Translational Motion
11. General Rotation (I) 2
    - Vector Cross Product
    - Torque About A Point
    - Angular Momentum of a Particle
    - Angular Momentum and Torque for a System of Particles; General Motion
    - Angular Momentum and Torque for a Rigid Body
12. General Rotation (II) 2
    - Rotational Imbalance

- Principle of Angular Momentum
- Conservation of Angular Momentum
- The Spinning Top
- Rotating Frames of Reference; Inertial Forces
- The Coriolis Effect

13. Temperature and the Ideal Gas Law 2
    - Atomic Theory of Matter
    - Thermal Equilibrium and the Zeroth Law of Thermodynamics
    - Temperature Scale
    - The Ideal Gas Law
    - Problem Solving with the Ideal Gas Law
    - Ideal Gas Law in Terms of Molecules: Avogadro's Number
    - Ideal Gas Temperature Scale – a Standard
14. Kinetic Theory of Gases (I) 2
    - The Microscopic Model of Ideal Gas
    - Molecular Interpretation of Temperature
    - Degree of Freedom
    - The Equipartition Theorem of Energy
    - The Internal Energy of Ideal Gas
15. Kinetic Theory of Gases (II) 2
    - Distribution of Molecular Speeds
    - Maxwell Distribution of Speeds
    - Mean Free Path
16. Kinetic Theory of Gases (III) 2
    - Real Gases and Changes of Phase
    - Vapor Pressure and Humidity
    - Van der Waals Equation of State
17. First Law of Thermodynamics (I) 2
    - Heat as Energy Transfer
    - Internal Energy
    - Specific Heat
    - The Fist Law of Thermodynamics
18. First Law of Thermodynamics (II) 2
    - Applying the First Law of Thermodynamics; Calculating the Work
    - Molar Specific Heats for Gases
    - Adiabatic Expansion of a Gas
    - Heat Transfer: Conduction, Convection, Radiation
19. Second Law of Thermodynamics (I) 2
    - Cyclic Process and Its Efficiency
    - Heat Engines
    - Reversible, Irreversible Processes, and Carnot Engine
20. Second Law of Thermodynamics (II) 2
    - Refrigerator, Air Conditioner, and Heat Pump
    - Entropy
    - Second Law of Thermodynamics
    - Order to Disorder
    - Energy Availability; Heat Death
    - Statistical Interpretation of Entropy and the Second Law
21. Oscillations (I) 2
    - Oscillations of a Spring
    - Simple Harmonic Motion (SHM)
    - The Simple Pendulum
    - The Physical Pendulum
22. Oscillations (II) 2
    - Energy in Simple Harmonic Motion
    - Superposition of Oscillations

- Damped Harmonic Motion
- Forced Vibrations; Resonance

23. Wave Motion (I) 2
    - Generation and Propagation of Waves
    - Simple Harmonic Wave
    - The Quantities for Describing Wave Motion
    - The Wave Function of Simple Harmonic Waves
24. Wave Motion (II) 2
    - Energy Transported by Waves
    - Superposition of Waves
    - The Doppler Effect
25. Interference of Light (I) 2
    - The Nature of Light
    - The Mechanism of Light Emission
    - The Interference of Dividing Wavefront
    - Interference - Young's Double-Slit Experiments
    - Coherence
    - Intensity in the Double-Slit Interference Pattern
26. Interference of Light (II) 2
    - Interference of Equal Inclination
    - Michelson Interferometer
    - Interference of Equal Thickness
    - Newton Rings
    - Luminous Intensity
27. Diffraction of Light (I) 2
    - Phenomenon of Diffraction
    - Huygens-Fresnel Principle
    - Fraunhofer Single-Slit Diffraction
    - Fraunhofer Circular Aperture Diffraction
28. Diffraction of Light (II) 2
    - Resolution of Optical Instruments
    - Resolution of Human Eye
    - Diffraction Grating
    - The Spectrometer and Spectroscopy
    - Peak Widths and Resolving Power for a Diffraction Grating
    - X-Rays and X-Ray Diffraction
29. Polarization of Light (I) 2
    - Unpolarized Light, Linearly Polarized Light and Partial Polarized Light
    - Polarizer, Analyzer and Malus's Law
    - Polarization by Reflection and Brewster's law
30. Polarization of Light (II) 2
    - Polarizing of Double Reflection of Light
    - Polarized Prism and Wave Plates
    - Scattering of Light by the Atmosphere
31. Reviews (I) 2
    - Particle Mechanics
    - Rotational Motion of Rigid Body
    - Kinetic Theory of Gases
32. Reviews (II) 2
    - Thermodynamics
    - Oscillation and Wave Motion
    - Wave Optics

Laboratories and Laboratory Hours:

1. Laboratories Hours: N/A
2. Laboratory Hours: N/A

Grading:

Attendance	5%
Homework	20%
Project	5%
Final	70%

Text & Reference Book:
D. C. Giancoli, Physics for Scientists and Engineers with Modern Physics, 3th ed., ISBN 978-7-04-016563-0.

101180121 College Physics II

Lecture Hours: 64
Laboratory Hours: 0
Credits: 4
Term: 1
Prerequisite(s): Higher Mathematics, College Physics I

Course Description:
This course is a calculus-based physics course for science and engineering majors. The topics cover: Charge and matter, Electric field, Gauss's law, Electric potential, Capacitors and dielectrics, Current and resistance, Electromotive force and circuits, Magnetic field, Ampere's law, Faraday's law, Inductance, Maxwell's equations, Special Relativity, Wave and particle duality, Matter waves, Schrödinger's equation, The course emphasizes the understanding of the physics concepts and principles, equips the students with effective problem-solving skills. The students should be able to apply physics principles to real-world problems.

Course Outcomes:
After completing this course, students should be able to:
1. Understand the physics principles and concepts governing electromagnetism, special relativity and quantum physics.
2. Analyze electric fields and forces for simple arrangements of static charges using Gauss's Law and Coulomb's Law.
3. Analyze magnetic fields for simple arrangements of currents using Ampere's Law.
4. Analyze electric fields and magnetic fields for simple arrangements of changing electric and magnetic fields using Faraday's Law and Ampere's Law.
5. Describe the Special Theory of Relativity.
6. Solve problems using time dilation and length contraction.
7. Describe the wave-particle duality of light.
8. Investigate the nature and structure of the atom.
9. Define a de Broglie or matter wave.
10. Develop the mathematics required to solve a one dimensional Schrodinger equation system.

Course Content:
Lectures and Lecture Hours:
1. Electric Forces and Fields 9
- Electric Charge
- Conductors and Insulators
- Coulomb's Law
- The Electric Field
- Motion of Point Charges in Electric Fields
- Conductors in Electrostatic Equilibrium
- Gauss's Law for Electric Fields

2. Electric Potential 5
- Electric Potential Energy
- Electric Potential
- The Relation Between Electric Field and Potential
- Equipotential Surfaces
- Conservation of Energy for Moving Charges

3. Electrostatic Energy and Capacitance 4
- Electrostatic Potential Energy
- Capacitors and Capacitance
- Combinations of Capacitors
- Dielectrics

- Energy Stored in a Capacitor

4. Electric Current and Circuits 2
- Electric Current
- Emf and Circuits
- Microscopic View of Current in a Metal: The Free-Electron Model
- Resistance and Resistivity
- RC Circuits

5. Magnetic Forces and Fields 10
- Magnetic Fields
- Magnetic Force on a Point Charge
- Motion of a Charged Particle in a Magnetic Field
- Magnetic Force on a Current-Carrying Wire
- Torque on a Current Loop
- The Hall Effect
- The Magnetic Field of Currents
- Gauss's Law for Magnetism
- Ampere's Law
- Magnetic Materials

6. Electromagnetic Induction 8
- Induced Emf
- Faraday's Law
- Lenz's Law
- Motional Emf
- Eddy Currents
- Induced Electric Fields
- Inductance
- Energy Stored in a Magnetic Field

7. Electromagnetic Waves 2
- Maxwell's Equations and Electromagnetic Waves
- The Electromagnetic Spectrum
- Speed of EM Waves in Vacuum and in Matter
- Characteristics of Travelling Electromagnetic Waves in Vacuum
- Energy Transported by EM Waves

8. Special Relativity 8
- Newtonian Relativity
- Einstein's Postulates
- Simultaneity
- Time Dilation
- Length Contraction
- The Lorentz Transformation
- The Velocity Transformation
- Relativistic Momentum
- Mass and Energy
- Relativistic Kinetic Energy

9. Quantum Physics 16
- Planck's Quantum Hypothesis
- Photon Theory of Light and the Photoelectric Effect
- The Compton Effect
- Wave-Particle Duality
- Hydrogen Spectrum and the Bohr Model
- Wave Nature of Matter
- The Wave Function and Its Interpretation
- Heisenberg Uncertainty Principle
- The Schrödinger Equation
- Particle in an Infinitely Deep Square Well Potential
- Tunneling through a Barrier

- The Harmonic Oscillator
- Hydrogen Atom and Quantum Numbers
- The Spin-Orbit Effect and Fine Structure
- The Periodic Table of Elements
- Electron Energy Levels in a Solid
- Lasers

Grading:

Homework	25%
Inclass Quizzes	10%
Final	60%
Instructor Evaluation	5%

Text and Reference book:

[1] D. C. Giancoli, "Physics for Scientists and Engineers with Modern Physics", 3rd Ed. 2005, ISBN 7-04-016563-5

[2] P. A. Tipler, "Physics for Scientists and Engineers", 4th Ed. 1999

102172501 Linear Algebra A

Lecture Hours: **56**
Laboratory Hours: **0**
Credits: **3.5**

Course Description

The course introduces the elements of linear algebra, include matrix algebra, linear system, vector space, linear transformation, determinant, eigenvalues, orthogonality. The course also introduces the logical sequence of advanced mathematics, in particular to the role and construction of proofs. The students should be able to apply linear algebra and matrices in mathematics and practical issues.

Course Content

Lectures and lecture hours

Lectures	Hours	Teaching methods
Chapter 1: Matrices, Vectors and Linear systems	12	Lecture and discussion
1.1 Matrices and vectors		
1.2 Linear combinations, matrix-vector products, special matrices		
1.3 Linear systems and Gaussian elimination		
1.4 Span of a set of vectors		
1.5 Linear dependence and independence		
Chapter 2: Matrices and linear transformations	10	Lecture and discussion
2.1 Matrix multiplication		
2.2 Invertibility, elementary matrices, the inverse of matrix		
2.3 Partitioned matrices and block multiplication		
2.4 Linear transformations and matrices		
2.5 Composition and invertibility of linear transformations		
Chapter 3: Determinants	5	Lecture and discussion
3.1 Cofactor expansion		
3.2 Properties of determinants		
Chapter 4: Subspaces and their properties	9	Lecture and discussion
4.1 Subspaces		
4.2 Basis and Dimension		
4.3 Subspaces associated with a matrix		
4.4 Coordinate systems		
4.5 Matrix represenation of linear operators		
Chapter 5: Eigenvalues and eigenvectors	6	Lecture and disccusion
5.1 Eigenvalues and eigenvectors		
5.2 The characteristic polynomial		
5.3 Diagonalization		
Chapter 6: Orthogonality	10	Lecture and disscusion
6.1 Inner product, orthogonality, orthogonal projection		
6.2 Orthogonal set, orthogonal matrix		
6.3 Orthogonal subspaces, least squares and orthogonal projection		
6.5 Gram-Schmidt orthogonalization		
6.6 Real symmetric matrices		
6.7 Singular value decomposition		
Two review sessions during the term	4	Lecture and disccusion

Grading

Homework	10%
Mid-term Exam	20%
Final Exam	70%

Textbook:

L. Spence, A. Insel and S. Friedberg, "Elementary Linear Algebra: A Matrix Approach", second edition, Pearson, 2008.

References:

[1] D. Lay, S. Lay and J. Mcdonald, "Linear Algebra and its Applications", fifth edition, Pearson, 2016.

[2] Some supplementary lecuture notes shall be provided when necessary.

104210001 Introduction to Management

Lecture Hours: **32**
Credits: **2**
Term(If necessary): Second year, third or forth semester
Prerequisite(s): None

Course Description:
This course is an introductory level management course that deals with the principles of management theory and practice. This course provides instruction in principles of management that have general applicability to all types of organizations. Emphasis is placed on the functional approach including planning, organizing, leading, and controlling. To learn and understand the basic management principles in order to build a solid foundation for future career success. The goals of this course are to provide a broad base of knowledge about organizations, about the environments in which they operate, and about the related roles and responsibilities of managers. This course will provide the opportunity to use this knowledge to develop specialized skills and competencies crucial to the successful leadership of modern organizations.

Course Outcomes:
After completing this course, a student should be able to:
1. Develop a preliminary overview of the field of Management for business majors.
2. Analyze practical problems and phenomena associated with corporate operations…
3. Use the principles of management to analyze and solve specific issues of organizations.

Course Content:
Lectures and Lecture Hours:

Grading:

Assignment	20%
Inclass Quizzes	40%
Final Exams	40%

Text & Reference Book:
Qiao Zhong, Zhou Biwen. Management 3rded. Beijing: China Machine Press, 2015.

104210004 Essentials of Economics

Lecture Hours: 16
Laboratory Hours: 0
Credits: 1
Prerequisite(s): None

Course Description:

Essentials of Economics is an introductory undergraduate course that teaches the fundamentals of economics. It provides a foundation for many years of study in economics, business, or related fields, as well as for economic analysis and thinking that can last throughout the students' education and subsequent professional careers.

This course provides an introduction to economics concepts and issues. It will introduce demand and supply, how market prices are determined, the production function, output and various cost curves, how the entire economy operates and the role of government in fostering an environment in which prices are stable, unemployment is low and the economy is growing. We will also explore the basis of and benefits from trade and the determination of the exchange rate. The entire course is built around the development and usage of demand and supply analysis in order to address a variety of issues that are important to economists, policy makers and the average citizen.

Course Outcomes:

After completing this course, a student should be able to:

- Understand general economic terminology, concepts, and theories;
- Develop a range of skills enabling them to analyze general economic problems;
- Understand price theory, elasticity, market dynamics and market failures;
- Use supply and demand diagrams to analyze the impact of overall changes in supply and demand on price and quantity;
- Understand firm's behavior and cost theory;
- Analyze different types of market structures, including perfect competition, monopoly, oligopoly and monopolistic completion;
- Understand government role regarding business;
- Understand theory of consumer choice;
- Learn how to measure a nation's income
- Understand the meaning of the business cycle and its phases;
- Understand the meaning of unemployment and inflation;
- Understand the basic Aggregate Supply, Aggregate Demand model of the macro economy;
- Understand how policy operates, its tools, and its advantages and drawbacks;
- Understand how a financial system works;
- Understand how fiscal and monetary policy operates, its tools, and its advantages and drawbacks;
- Understand the basic open-economy macroeconomics.

Course Content:

Lectures and Lecture Hours:

1.	Ten principles of economics; Economic models	2
2.	Market forces of supply and demand; Elasticity	2
3.	Market failures	1
4.	Cost theory; Different market structures	2
5.	Theory of consumer choice	1
6.	Measuring a nation's income	2
7.	Economic growth; Economic cycles; Unemployment	2
8.	Money and financial system; Inflation	1
9.	Open-Economy Macroeconomics: Exchange rates; International trade	1
10.	Aggregate demand and aggregate supply; policies	2

Grading:

Class attendance & performance	10%
Written homework	20%
Weekly quizzes	20%
Final exam	50%

Text & Reference Book:

N. Gregory Mankiw, Principles of Economics, 6e, Peking University Press, 2012
John Sloman, Dean Garrett, Essentials of Economics, 6e, Tsinghua University Press , 2014
Joseph E. Stiglitz, Carl E. Walsh, Economics, 4e, Renmin University Press , 2010