Undergraduate Program for Specialty in Automation

College of Control Science and Engineering
Zhejiang University

Fundamentals of Programming

Hours: 64 hours
Credit: 3.0
Course Description:

This course will mainly introduce to the students the C programming language and its programming technology, and explain the basic algorithms of solving the problems. This course aims to make the students know the components of the high level programming language, master the basic processes and skills of programming, possess the basic abilities of programming in high level programming languages. The main contents of this course include: the basic data types and expressions, the basic flow-controlling of the programs, the functions and modular programming, the data array and file applications, the basic alogrithms, etc.

Program Design Project

Hours: 48 hours
Credit: 2.0
Course Description:

Based on the course “Fundamental of Programming”, this course will introduce to the students the four special topics to improve more the abilities of programming using the advanced programming languages, especially of the organizations of the complex data and the designs of the basic algorithms. The four special topics include: programming using modular, the basic of graphics programming, the structure/chain list and the statck, the search/sort algorithms and its analysis.

Calculus (A) I; Calculus (A) II

Hours: 80+72=152 hours
Credit: 4.5+3.5=8.0 credits in total
Course Description:

Calculus is a mathematical subject, which studies the functions, applies the method of limits (i.e. limit process like infinitesimals and infinite approximation) to analyze and deal with issues, with 80 class hours. The teaching content includes: function limits and continuity, differential calculus of one variable functions and its appliances, integral calculus of one variable functions and its appliances.

The Methods of discussion and case study will be used in this course, and the capacity of

quick-primary policy analysis will be emphasized.

Linear Algebra (A)

Hours: 48 hours
Credit: 2.5
Course Description:

This course is a degree program for undergraduate students of Zhejiang University whose majority is in the field of engineering and science, etc. It includes the theory of solving linear equations, the basic theory of matrix, linear space and quadratic form, and an introduction to the theory of linear transformation, which are very useful in science and technology.

University Physics (A) I

Hours: 64 hours
Credit: 4.0
Course Description:

University Physics A1 includes the following contents: Newton's mechanics on calculus level, rotational motion of rigid body, theory of relativity; oscillations and wave motion, thermodynamics; foundation of electrostatics. The learning of the course enables students to gain a comprehensive understanding of the principles of the moving of objects, giving an initial training of students' methods of thinking and capabilities to investigate problems scientifically. It cans also lay students a solid physical foundation for further learning (for Polytechnic postgraduates) and for learning new theories, new knowledge and new technologies.

University Physics (A) II

Hours: 64 hours
Credit: 4.0
Course Description:

University Physics A2 includes the following contents: electromagnetism, optics; the foundation of quantum physics; selected lecture of the advance front in physics. The learning of the course enables students to gain a comprehensive understanding of the principles of the moving of objects, giving an initial training of students' methods of thinking and capabilities to investigate problems scientifically. It cans also lay students a solid physical foundation for further learning (for Polytechnic postgraduates) and for learning new theories, new knowledge and new technologies.

College Physics Experiment

Hours: 48 hours
Credit: 1.5
Course Description:

The course content mainly bases on basic experiments, design experiments and a series of experiments awarded the Nobel Prize in Physics for the composition. To train students ability to solve practical problems and to develop innovation ability, the application of modern technology in physics experiments has opened, the comprehensive experimental and design experiments are in the more proportion of the course, which helps students lay a solid foundation for the subsequent experiments and future research work.

Introduction to Entrepreneurship

Hours: 64 hours
Credit: 2.0
Course Description:

Introduction to Entrepreneurship is a compulsory course open to all undergraduate students at Zhejiang University. Using the way of MOOCs (Massive Open Online Courses), this course encourages students to combine online learning and offline discussion, so as to enhance the entrepreneurial mindsets and competence. It includes three Modules: a) acknowledging entrepreneurship and entrepreneurs; b) understanding the process of entrepreneurship; c) learning the current situation and tendency of entrepreneurship education from an international perspective.

Engineering Graphics

Hours: 48 hours
Credit: 2.5
Course Description:

Engineering Graphics is a basic technical course, it involves not only systemic theory, but also technical practice. The course aims at engineering drawing, focus on the principles and methods of making and reading engineering drawings, trains the ability of students to imagine three-dimensional solids according to orthographic projections. The main contents of the course include orthographic projection method, fundamental principles and knowledge of drawing, simple mechanical drawing and computer aided drawing etc.

Introduction of Automation

Hours: 16 hours
Credit: 1.0
Course Description:

As an introduction course to the junior students who major in automation, its main aim is to help them to understand the basic principles of automatic control systems and take a keen interest

in the automation specialty by means of lecture as well as demonstration. The main lecture topics include the concept of control systems, the principle of robot systems, sensors used in industry, the principle of computer networks, big-data analysis methods, process control systems and application.

Ordinary Differential Equations

Hours: 16 hours
Credit: 1.0
Course Description:

This course teaches basic theory and techniques of Ordinary Differential Equations (ODEs). It includes the following two parts: First-Order Differential Equations and Higher Order Linear Equations and linear Systems.

Engineering Training

Hours: 48 hours
Credit: 1.5
Course Description:

Engineering training is a practical technical basic course, it use mechanical manufacture process as platform, use mechanical manufacture technology as mean, it is mostly about practical teaching, and students are expected to attain follow targets through independent operation.(1) Be familiar with common machining methods of mechanical parts and working principle and typical constitution of mostly facilities used and use of tools, clamps, measures and techniques of safety operation in order to acquaint with whole process of mechanical production. (2) Cultivate primary capability of choosing material, block, process techniques of machining of simple parts and capability of conducting process techniques analysis. (3) Have a systematically comprehension of numerical control technology, computer aided manufacture technology and non-traditional machining etc. in mechanical manufacture field.

Complex Variable Functions & Integral Transformation

Hours: 32 hours
Credit: 1.5
Course Description:

Complex analysis is the knowledge of mathematics that the science and engineering undergraduate students should have. It is a course following the calculus. It includes analytic function、contour integrals、Cauchy's Integral Formula、Laurent' Series、Conformal Mappings and Laplace Transforms.

Probability and Mathematical Statistics

Hours: 48 hours
Credit: 2.5
Course Description:

This is an important basic course for undergraduate students. The main theme of the subject is the study of the quantitative patterns of "random phenomena", including events and probability, random variables and their distributions, the numeric characters of random variables, the law of large numbers, and the central limit theorem, statistical quantities and sampling distribution, the point estimation and interval estimation of parameters, the hypothesis testing of parameters and the fitting testing of probability distribution, variance analysis and regression analysis.

Electric Circuit and Analog Electronic Technology

Hours: 88 hours
Credit: 5.5
Course Description:

This course forms the basic knowledge structure of electronic and information engineering. By teaching fundamental theories and analysis technique, this course makes students master core concepts of circuit and electronic technology, build up basic skills of analyzing analog circuits and systems, apply mathematic methods to analyze steady-state and transient. This course is a combination of Electric Circuit and Analog Electronic Technology, attaching some relevant content of engineering analysis and computer aid analysis.

Electric Circuit and Analog Electronic Technology Experiment

Hours: 48 hours
Credit: 1.5
Course Description:

Through the course Electric Circuit and Analog Electronic Technology Experiment, students learn how to manipulate common electronic device, measure basic electrical parameters, analyze and calculate errors. Besides, they can learn how to design an experiment, sketch experimental curves, and run simulation software. Based on the basic principles of electric circuit, students first are led to analyze and modify circuits, then to design function circuits and system circuits, and finally to discuss and explore.

Partial Differential Equations

Hours: 32 hours
Credit: 2.0
Course Description:

This course is a degree program for undergraduate students of Zhejiang University. It covers six parts: a) Introduction of the typical partial differential equations of applied mathematical physics: Heat equations, Wave equations and Laplace equations. b) Method of characteristics for wave equations, c) Solution by separation of variables, d) Fourier transform method and Laplace transform method. e) Green's function and its application. f) Bessel function and Legendre function

Digital Circuit Analysis and Design

Hours: 56 hours
Credit: 2.5
Course Description:

This course includes two parts: theory part and experiment part. The theory part introduces Combination Circuit Design, Sequential Logical Circuit Design, and Mixed-signal Circuit Analysis, etc. According to the teaching characteristics, theory teaching takes " DOWN TO TOP" teaching mode. It starts with unit circuit design and the design method of classical unit circuit (medium scale integrated circuit). Then complex circuits or digital systems combined with all sorts of unit circuits are introduced. Experiment teaching includes designing unit digital logic circuit and the digital clock circuit with midium scale digital integrated circuit, and the design of comprehensive digital system with EDA tools.

Principles of Automatic Control Ⅰ
Hours: 64 hours
Credit: 4.0
Course Description:

This course aims to systematically introduce basic concepts, principles and applications of automatic control theory. Formulation of control problems in time domain, complex-frequency domain and state-space will be included. Different system representation methods (block diagram, transfer function and signal flow graph) will be firstly covered. Thereafter, analysis and design methodologies in time and frequency domain including root-locus and frequency-response methods will be presented. Various techniques to improve system performance such as cascade and feedback compensators will be finally emphasized.

Principles of Automatic Control Ⅱ
Hours: 48 hours
Credit: 2.5
Course Description:

This course follows Principles of Automatic Control I, aims to systematically introduce basic concepts, principles and applications of automatic control theory. Analysis and design of digital control systems, analysis and synthesis of linear dynamical systems in state-space equations form, and basic concepts of nonlinear systems will be included. Foundation of modern control theory

based on space-state model is detailed.

In addition to the quoted above, some associated laboratory exercises will be performed on a Laboratory Toolbox or by MATLAB CAD package.

Sensing and Measurement

Hours: 80 hours

Credit: 4.0

Course Description:

Modern Sensing and Measurement is a course focusing on measurement technology and automation. This module mainly discusses the principle of various sensors, measurement instrumentation and measurement technology with the aim of enhancing students' understanding during designing and developing different measurement systems and automation systems. Course content mainly includes the most used sensors and transducers' operation principles and basic characters. Furthermore, the principle, constitution, design method, basic feature and engineering application examples of typical measurement instruments and measurement systems are covered. The class provides students with the opportunities to be familiar with the basic application background of diverse measurement systems and control systems.

Signals & Systems

Hours: 32 hours

Credit: 2.0

Course Description:

This course includes the basic knowledge required for undergraduate students of Faculty of Information of Zhejiang University. It relates the basic concepts, principle, and methods for analyzing linear and time-invariant systems. Both the continuous-time and discrete-time systems are parallel discussed in the contents. Transforms among time domain, frequency domain, and complex frequency domain are elaborated. The contents of this course are essential for further study in the other courses like Digital Signal Processing, Principles of Automatic Control, Control Engineering, and Communication.

Embedded System

Hours: 80 hours

Credit: 4.0

Course Description:

"Embedded system" is the update course of "Microcomputer Principle and interface technology", which is one of the basic courses of engineering undergraduates. Through the study of course, students are enable to master the basic theory and practice of the embedded system, familiar with the programming of embedded system, and interface technology. Based on the 8051 and ARM chip, the whole concept of embedded system is established, and the software and hardware design and development capability are achieved.

Introduction of Robot

Hours: 72 hours

Credit: 3.5

Course Description:

Robotics is a multidisciplinary cross subject, includes mechanics, material, electronics, transducer, computer, control and so on. This course introduce the basic knowledge of robot, including robot learning drive, transmission, mechanism, sensor, MCU and other professional knowledge. The students will design and manufacture the robot, improving ability of innovation and practice.

Robotics

Hours: 56 hours

Credit: 3.5

Course Description:

This course is a degree program for undergraduate students of Zhejiang University. It include three parts: a) Mechanical manipulation theory which is fundamental for any robot. b) Methods and methodology in autonomous mobile robots. c) Some important theory correlative to the study of humanoid robots.

The Methods of discussion and case study will be used in this course.

Design and practice of robot

Hours: 96 hours

Credit: 3.5

Course Description:

This is a companion course of Robotics (code 86120080) which focuses on the design and practice aspects of robotics technology. Three typical robotic platforms will be adopted including omni-directional wheeled robots, humanoid bipedal walking robots, and industrial robots. Through hands-on experiments and practices on these platforms, student are expected to have better understandings on the theoretical parts of robotics courses such as motion planning, gait generation and balance control, and path/trajectory planning. Students will choose one of the three robots as their major practice platform. The course is designed for students to grasp practical technologies of robots and inspire their innovative thinking. Students are required to attend lectures/discussions, conduct experiments on robots, propose design ideas and implement them on robots using knowledge learnt by themselves. The course also provides fundamental knowledge for student who will attend RoboCup soccer robot competitions of small-size and humanoid leagues.

Process Dynamics

Hours: 72 hours

Credit: 3.5

Course Description:

Process dynamics is a core course for automation and process control. It aims to teach students the basic concepts on process modeling, process analysis, and process simulation. It covers the unit operations, the modeling methods, and dynamic simulation. With experiments and software tools, it enables students to understand the dynamics of processes, which is also a fundamental for further study of process control.

Process Control Engineering

Hours: 72 hours

Credit: 3.5

Course Description:

Process Control Engineering is one of required course of automation control. By explaining the common automatic control methods used in practice processes, this course enables the students to analyze and design control systems and to satisfy the demands of the process industries. The main contents of the course include process dynamic characteristics analysis and modeling, feedback controllers and PID based control systems, multi-loop control system analysis and design, and typical industrial process control systems.

Design and Practice of Computer Control System

Hours: 96 hours

Credit: 3.5

Course Description:

The course is a comprehensive practice course for senior undergraduates majoring in automation. The goal of the course is to promote their ability for analyzing specialized issues of automation and solving the problem of computer control system design and engineering application. The basic knowledge of control engineering design principles, the design and development methods of distributed control systems (DCS) and programmable logic controller (PLC) system are briefly introduced and discussed. For several design tasks from control engineering practice, students will work in groups to design and develop a computer control system based on DCS and PLC. By this course, students will be familiar with computer integrated control system analysis, design, development, implementation，debugging and operation, which will obviously promote their ability for control system design and engineering application.

Mathematical Modeling & Simulating

Hours: 40 hours

Credit: 2.0

Course Description:

The course will serve as a bridge between the study of mathematics and the applications of mathematics to various fields. The course affords the student an early opportunity to see how the pieces of an applied problem fit together. The student investigates meaningful and practical problems chosen from common experiences encompassing many academic disciplines, including the mathematical sciences, operations research, engineering, and the management and life

sciences.

Data Structure

Hours: 40 hours

Credit: 2.0

Course Description:

The content of this course consists of the following four parts: Part One introduces some preliminaries including the concept of abstract data type (ADT) and the basic methods for time-space complexity analysis. In Part Two, fundamental data structures for stack, queue, list are discussed, together with their implementations. Part Three talks about implementations and analysis of sorting and searching. In Part Four, several advance data structures for tree, B tree, and graph are described, together with their implementations.

Numerical Method

Hours: 40 hours

Credit: 2.0

Course Description:

This course is offered to undergraduates and introduces the formulation, methodology, and techniques for numerical solution of engineering problems. Topics covered include: fundamental principles of digital computing, roots of nonlinear equations, solution of linear algebraic equation systems, curve fitting, interpolation and curve fitting, numerical differentiation and numerical integration, numerical solution of ordinary differential equations. If time permits, optimization problem might be discussed.

Object-oriented Programming Technology(JAVA)

Hours: 40 hours

Credit: 2.0

Course Description:

The course aims to introduce the basic theories and concepts of object oriented technique, and covers in detail the three characteristics of object oriented technology, i.e. encapsulation, inheritance and polymorphism, combining with the learning of grammar and basic skills of JAVA programming. On this basis, the course also includes some contemporary and practical technologies introduced in JAVA programming: exception and error handling, object collections classes library, etc.

Object-oriented Programming Technology(C++)

Hours: 40 hours

Credit: 2.0

Course Description:

The course will teach principles and methods of object-oriented programming techniques via

the C ++ programming language, the contents include the characteristics of object-oriented programming language and technical fundamentals on C ++. General chapter includes basic theory, class and object, constructor and destructor, functions, references, inheritance and polymorphism, copy constructor, operator overloading, exceptions, templates, and other streaming.

Introduction to Artificial Intelligence

Hours: 32 hours

Credit: 2.0

Course Description:

This course is an elective program for undergraduate students of Zhejiang University. It is an introductory course in the field of artificial intelligence. This course from the Angle of rational agents mainly introduces the primary research contents and the relevant solving methods involved in the field of artificial intelligence. The main contents include: rational agent, problem solving method, knowledge and reasoning, planning problem, the uncertain knowledge and reasoning, machine learning methods, etc. The basic goal of this course is to make students understand the mainly problems and the solution involved in artificial intelligence, and to master the current mainstream research direction in the field of artificial intelligence. The methods of discussion and case study will be used in this course.

Digital Signal Processing

Hours: 40 hours

Credit: 2.0

Course Description:

The signal for the sake of processing is mathematically modeled as a function or a sequence of numbers that represent the state or behavior of a physical system. Examples of signals range from moving speed and pressures in robotics and other control systems, speech, audio, image and video in multimedia systems, chemical and biochemical signals from optical or electrochemical sensors in analytical instruments, to ECG (electrocardiograms) and other physiological signals in medical systems.

Signal processing is concerned with the representation, transformation, and manipulation of signals and the information they contain. For example, we may wish to remove the noise in signal to make it clear. Digital signal processing is thus one of fundamental theories and techniques which are increasing more important in electronic products and other information systems of today. It is assumed that the students are familiar with complex variables and Fourier theory. This course covers subjects from the concept and the classification of discrete-time signal, representations of signals in time, frequency, z- and discrete frequency domains, representations and analyses of systems, to filter designs. It also explains the practical questions in analytical instrument, sensing and pattern recognition, automatic control system and engineering.

The overall goal of the course is to teach a systematic approach to the design process of digital signal processing algorithms and systems.

Techniques of Electrical Control

Hours: 48 hours

Credit: 2.5

Course Description:

The main contents of the course include power electronics, electrical machines, drives, electrical apparatus and control. It introduces operation principles, properties as well as the analytical techniques for DC machines, transforms，asynchronous machines and electrical drive systems, basic theory of power electronic technology, and motor drive systems.

Computer Simulation of Control System

Hours: 40 hours

Credit: 2.0

Course Description:

I. COURSE OVERVIEW

This course is offered to undergraduates and introduces the methodology and techniques for computer simulation and computer aided design of control systems. Topics covered include: representations and realization of continuous time systems, discretization methods of continuous time systems, simulation of continuous time systems and sampling control systems, computer aided process identification, computer aided design method based on frequency domain and time domain.

II. KNOWLEDGE POINTS

1 Discretization methods of continuous time systems

2 Simulation of continuous time systems

3 Computer aided process identification

4 Computer aided control system design

III. TEXT BOOK AND REFERENCE MATERIALS:

1 Qian Jixin, Wang Hui, Zhou Lifang, Zhao Yuhong. Control System Simulation and Computer Aided Design. Chemical Industry Press, 2010

Operation Research and System Engineering

Hours: 48 hours

Credit: 3.0

Course Description:

Understanding the basic theory and method of operations research and system engineering; Learning about optimization algorithms and methods，modeling and system analysis theory and methods，for complex system analysis and industrial process applications; Learning how to deal with practical system engineering problems using every branch of operations research，system prediction and system assessing.

Contents: Basic theory and methods of linear program, integer program, nonlinear program, game theory, graph theory, system prediction, system assessing and system decision, etc. The combination of basic theory and real world problems makes the students get great advance after this lecture.

Computer Network and Fieldbus Control System

Hours: 40 hours

Credit: 2.0

Course Description:

The course was based on computer networks, industrial communications, OSI reference model knowledgement. Students will further learn the widely used filedbus protocol, such as Foundation Fieldbus, PROFIBUS, HART, CAN, Ethernet, EPA and other fieldbus technology. They will establish overall concept of industrial communication networks and have capability to apply commercial industrial communication networks.

Data Analysis and System Identification

Hours: 32 hours

Credit: 2.0

Course Description:

There will be no control without models. System identification is the theory and methods for building system models using test data. Besides applications in automatic control, system identification can be applied broadly in finance, economy and management, environment science, health care and more. In Big Data era, system identification will play a big role in Dynamic Bid Data. This course will teach fundamentals of theory and methods of system identification; the students will learn how to use System Identification Toolbox of Matlab. The lecturer ZHU Yucai has done research on system identification for over 30 years. He will show many application case studies in the industry, finance and environmental research in or der to make the lectures more interesting.

DSP System Design

Hours: 40 hours

Credit: 2.0

Course Description:

With the progress of digital signal process technology, it is widely applied in many fields. Designing of digital signal processor based electronic system has become a basic skill for students major in automation. This course will systematically introduce the DSP from Analog Device Inc. The focus will be on the system design, hardware design and software design method.

Fundamentals of Advanced Control

Hours: 24 hours

Credit: 1.5

Course Description:

Based on the introduction of the concepts of advanced process control and integrated automation, this course tries to let students know the principles of the related techniques, expand the students understanding toward the knowledge about the fundamental and analysis method of the automatic control techniques and thus make them ready for the future application, design and

implementation of various control systems.

Optimization and optimal control

Hours: 48 hours

Credit: 3.0

Course Description:

Three parts will be covered in this course, including mathematics review (such as vector spaces and matrices, linear transformation and concepts of geometry, etc.) Then, the introductory materials of optimization will be covered, including mainly the unconstrained optimization and constrained nonlinear optimization. Last but not least, optimal control will be covered in this course, including calculus of variations, linear quadratic optimal control, discrete-time optimal control, Pontryagin maximum principle and optimal control with constraints.

Computer Network and Wireless Sensing

Hours: 40 hours

Credit: 2.0

Course Description:

The course aims to introduce to the student edge-cutting information technology. The main contents concern on the understanding of：the computer network architectures, including the basic concepts and the basic functions of each layer of ISO/OSI and TCP/IP architectures; the data communication technologies, including communication mode, digital signal coding, error checking and data exchange technology; The LAN technologies, including Ethernet; resource-constraint networks, characteristic of networked sensing and the challenge of wireless technology for industrial applications.

Machine Vision and Machine Learning

Hours: 56 hours

Credit: 3.0

Course Description:

This course is designed to learn the principles and methods of machine vision, and the latest achievement and development trends, implement the techniques and skills of machine vision system. The course contents include: review of machine vision technology, vision and imaging theory, projection geometry, image transform, image segmentation, image reconstruction, and machine vision system design. The Methods of discussion and case study will be used in this course, and the capacity of quick-primary policy analysis will be emphasized.

Aircraft Navigation and Control

Hours: 32 hours

Credit: 2.0

Course Description:

The course offers a basic introduction to the navigation and control techniques for aircrafts. Seven main topics are included: 1) the function and composition of an aircraft control system; 2) coordinate system and flight mechanics 3) dynamics analysis, modeling and simulation; 4) longitudinal and lateral motion analysis; 5) navigation principles for aircrafts; 6) control methods for aircrafts; 7) case study of a typical flight control system; 8) trends and challenges in flight control.

Flying Robot

Hours: 56 hours

Credit: 2.5

Course Description:

The course offers a basic introduction of air-robots. Eight main topics are included: 1) Basic concept of air-robots; 2) The fundamental concept of flight control system; 3) Navigation of air-robots; 4) Biomimetic flapping air-robots; 5) Swarm air-robot system; 6) Environmental perception of air-robots; 7) Case study of international air-robot competitions; 8) Trends and challenges in air-robots.

Robot Design

Hours: 24 hours

Credit: 1.5

Course Description:

Robotics is a multidisciplinary cross subject, includes mechanics, material, electronics, transducer, computer, control and so on.

This course focuses on training students the integrated design ability, innovative ability and engineering practice ability. The course is 24 credit hours of teaching. The top 3-4 excellent students will be selected to participate in the International Design Contest (IDC) each year.

Robot Implementation

Hours: 48 hours

Credit: 1.5

Course Description:

Robotics is a multidisciplinary cross subject, includes mechanics, material, electronics, transducer, computer, control and so on.

This course focuses on training students the integrated design ability, innovative ability and engineering practice ability. The course is 48 credit hours of practicing. The top 3-4 excellent students will be selected to participate in the International Design Contest (IDC) each year.

Major Cognition

Hours: 32 hours

Credit: 0.5

Course Description:

This is a basic practical course for freshmen in Automation (control) specialty. The course aims to introduce the training target, curriculum system and specific course requirements of automation specialty. And enable the students to know the disciplinary background and development prospects of the major and the resources which the undergraduates can be provided. Also students can understand the importance and feasibility of curriculum learning combined with scientific research training and creative ability cultivation.

Enterprise Cognitive Practice

Hours: 32 hours

Credit: 0.5

Course Description:

This course is offered to sophomores in Automation (control) specialty in their summer semester. The related enterprises visiting is arranged to help students increase the understanding of various industries. Students are required to visit with questions and bring problems back to class.

Electronic Engineering Training（A）

Hours: 48 hours

Credit: 1.5

Course Description:

This course by denso manufacturing equipment operation, installation and debugging of electronic information system, and the robot hands-on, parts design and assembly, etc to help electronic, information and related specialized student, from entering the university to study early, just set up electronic equipment manufacturing concept, electronic system installation and debugging and improving relevant key technology of electronic information preliminary electronic engineering knowledge and skills, and establish foundation for subsequent learning.

Experimental Technique Training

Hours: 64 hours

Credit: 1.5

Course Description:

This course is to train students' practical ability and to cultivate students' basic research accomplishment. The course adopts a project-based approach that requires students to independently design, install and debug a product project. Students are the protagonist of the course, and the teacher is responsible for answering questions.

The Methods of teaching and hands-on practices will be used in this course, and the ability to analyze and solve practical problems will be emphasized.

Practice of Measurement and Control System

Hours: 48 hours

Credit: 1.5
Course Description:

Basing on the heavy industrial enterprise process and control computer stimulation, students can learn the typical production instruments in the chemical engineering process, such as heat-exchanger, 65t/h boiler, heating furnace. Meanwhile, students will learn to handle the complex control system, as well as the ability of quick response to the accident and good analysis of the broken-down.

Advanced Experiment of Embedded System

Hours: 96 hours
Credit: 1.5
Course Description:

This course is offered to the undergraduates of electronic information to improve the design and application ability of single chip microcomputer. The course contents include: design and development of embedded system, advanced language program design methods with single chip microcomputer, peripheral circuit and commonly used sensor interface, software and hardware design of single chip microcomputer application systems.

Scientific Research Training

Hours: 64 hours
Credit: 1.0
Course Description:

This is a practical course combined with the second class. Students can apply the course credit if one of the following requirements is satisfied: 1) Scientific research paper with first author or the tutor as the first author and the student himself as the second author is published in core journals or above; 2) The university special class or provincial first class or national two class and above reward are awarded in the disciplinary competitions recognized by the university; 3) Long term project internship in enterprises over 3 consecutive weeks; 4) Scientific research training program recognized by the university is completed; 5) Foreign exchange (Research training program) for more than 3 weeks.

Integrative Experiment of Automation

Hours: 48 hours
Credit: 1.5
Course Description:

The project based lab exercises course for automation is oriented at the integrative training of the knowledge learned from this major’s basic courses. By doing practical project training, students can deeply understand the principle of industrial control system and method of advanced control. Meanwhile, students can learn the new technique and method of automatic control system, as well as the ability of imposing the theory into the practical work.

Dissertation Project

Hours: 512 hours

Credit: 8.0

Course Description:

The dissertation project is one of the most important aspect of the practice teaching for undergraduates, which aims to cultivate students' ability to solve the problems in the field of automation. Students are trained to do research related with the field of automation independently through the dissertation project. Students are required to make comprehensive use of what they have learned to analyze and solve general scientific research and engineering technical problems of automation.

Software Technology

Hours: 40 hours

Credit: 2.0

Course Description:

This course is a basic professional course for non-computer majors to learn, understand and grasp the technology of system software design, application and development. It mainly introduces the basic knowledge, method and practical technique of computer software design. The kernel content includes the basic knowledge of software technology, software engineering, software design, software programming, software implementation, software testing, data structure, database, graphic user interface design, operating systems and communication.

Control Engineering Science Frontiers

Hours: 24 hours

Credit: 1.5

Course Description:

This course covers broad areas arising in scientific frontiers, mainly the motion science, from physics to informatics. Generally, it cares about any motion in the nature, including both classical and quantum motion. It starts with mass point in the three dimensional space. Then linear algebra tools and physics will be applied to handle kinematics in the 3-dimensional space, in a mathematical way. Analytical dynamics will be covered to model complex behaviors of robotic mechanisms as wells as dynamic walking of human being.We also care about collective motion in nature, such as bird flocking, which motivates our research on robotic swarming. As a special topic of natural locomotion in bird flying and fish swimming, this course discusses flow measurement for mechanism studies. Last but not least, this course tries to cover some fundamental content on quantum mechanics and Bose-Einstein condensate arising quantum information and quantum computing. Especially, it will motivate two important research topics in optimal control of quantum physics and visual computing of quantum liquid.

Introduction to Internet of Things Technology

Hours: 24 hours

Credit: 1.5
Course Description:

The Internet of Things can get access to information everywhere in the real world by use of various types of sensors such as two-dimensional code, RFID, and other equipment and networks including the Internet and other types of heterogeneous networks, which can achieve efficient information interaction between the machine and the machine, the machine and the human, and support the intelligent application of information technology, and ultimately achieve full integration of intelligent infrastructure and physical infrastructure. The Course will introduce the basic principles of the Internet of Things, and its typical application in various fields from system design perspective. The Methods of discussion and case study will be used in this course.

Introduction of Logistics Automation

Hours: 24 hours
Credit: 1.5
Course Description:

In the view of systems control, this course introduces the framework of logistics automation systems and its modeling, simulation, control and design method. More specifically, the techniques such as automated identification, inventory control, automated warehouse systems, Automated Guided Vehicles Systems (AGVS), delivery automation and production logistics and so on are introduced. By studying the above techniques, the students are expected to be able to model, simulate, control and design a system of logistics automation.

Biosensors and Their Applications

Hours: 32 hours
Credit: 2.0
Course Description:

A biosensor is an analytical device, used for the detection of an analyte, what combines a biological recognition component with a physicochemical detector. The general aim of the design of a biosensor is to enable quick, convenient testing at the point of concern or care where the sample was procured. This course includes: a) History and the development of key technologies of biosensors. b) The structure and some important fabrication technologies correlative to selective bio-element and sensitive detector in a biosensors. c) New methods and integration for a microarrayed and microfluidic biosensors. d) Applications of biosensors.

The biological recognition element is a biologically derived material e.g. tissue, microorganisms, organelles, cell receptors, enzymes, antibodies, nucleic acids, etc. that interacts or recognizes with the analyte of interest. The transducer or detector element working in an electrochemical, piezoelectric, surface plasmon resonance (SPR), etc. transforms the physicochemical signal resulting from the interaction of the analyte with the biological element into electrical signal that can be more easily measured and quantified for a signal processor or control system. A widely used research tool, the biochip based on micro-array, microfluidics can also be considered a biosensor. There are many potential applications of biosensors of various types including an electrochemical, piezoelectric, SPR. The main requirements for a biosensor

approach are the identification of a target molecule. Some examples are glucose monitoring in diabetes patients, the detection of pesticides and river water contaminants such as heavy metal ions, determination of drug residues in food, such as antibiotics and growth promoters.

The Methods of discussion and case study will be used in this course. The overall goal of the course is to teach a systematic approach to the applications of biosensors of various types in measurement or control of an anlyte in solution.

Intelligent Control

Hours: 24 hours

Credit: 1.5

Course Description:

This course introduces concepts, technologies and applications concerning intelligent control. Through the course study, the students should understand history and development of intelligent control, obtain the basic knowledges and main features of hierarchical control, expert control, fuzzy control, neural control, learning control and evolutionary control. The course gives the representative application of intelligent control technique, which makes the students have ability to design simple intelligent control system.

Public Security Detection Technology

Hours: 24 hours

Credit: 1.5

Course Description:

Public safety, represented by food safety, belongs to the national security category. Public safety detection technology is one of the necessary technologies for the national “Ten words” development strategy. This course covers: First, the scope and main concepts of public safety detection technology: the definition and scope of public safety, food safety as an example to illustrate its history, economic and social attributes, contemporary main features; public safety detection technology overview and the latest developments. Second, the amount of component detection technology overview: analysis of chemical definitions and development process, error and effective figures. Third, the spectrum technology and equipment: Overview of spectral detection technology; device-level Atomic emission, absorption and fluorescence spectroscopy technology and equipment; the latest development of spectral technology. Fourth, mass spectrometry technology and instrumentation: the main concepts of mass spectrometry and the development process, the device-level introduction of mass spectrometry technology and instruments. Fifth, the novel sensor detection technology: the definition and composition of biosensors, CPS framework of the sensor detection technology.