

2010-2011 Course Catalog

The University Of Montana

Department of Applied Computing and Electronics

Thomas Gallagher, Chairman

The Department of Applied Computing and Electronics of The University of Montana College of Technology collaborates with business and industry to prepare graduates to compete in and contribute to a diverse, dynamic global society. Students acquire the practical skills necessary to pursue entry-level careers in STEM-related (Science, Technology, Engineering, and Mathematics) occupations. Students engage in experiential learning embracing technical education, effective communication, problem solving, professionalism, and workplace skills. The department promotes life-long learning to empower students in an ever-changing world. More details on programs available through the department can be found on the web: <http://ace.cte.umt.edu>.

Special Degree Requirements

General education requirements are integrated into the following programs. Refer to the Academic Policies and Procedures section of this catalog for the specific requirements.

Computer Aided Design - Certificate of Applied Science

The Computer Aided Design program introduces students to graphic communications; computer-aided design and modeling systems; geographic information systems; surveying; written communication; and business practices. Graduates are prepared to pursue entry-level, professional careers as technicians supporting civil engineering firms, surveyors, and land-use planners.

| First Year | A | S |
|--|---|---|
| BUS 103S Principles of Business | - | 3 |
| CSCI 105 (CRT 111) Computer Fluency | 3 | - |
| CADX 110 (CRT 182T) Intro to Computer Aided Design | 2 | - |
| CADX 131 Technical Graphics | 3 | - |
| CADX 142 (CRT 175) Geospatial Technologies | - | 3 |
| CADX 156 Computer Aided Design II | 3 | - |
| CADX 212 (CRT 184) Civil Design Technologies | - | 4 |

| | | |
|--------------------------------------|----|----|
| CSCI 172 (CRT 172) | - | 3 |
| Introduction to Computer Modeling | | |
| HEO 195 Special Topics: Surveying | 3 | - |
| M 121 (MAT 118) College Algebra | 3 | - |
| WRIT 101 (WTS 101) College Writing I | - | 3 |
| TOTAL | 17 | 16 |

Computer Technology - Associate of Applied Science

Thomas Gallagher, Director

Students in the Computer Technology program prepare for careers in the field of information technology. The mission of the program is to prepare students to meet the needs of users within an organization and societal context through the selection, creation, application integration, and administration of information technology. The program balances technical expertise with the professional skill set needed in a dynamic society. The degree program allows students to specialize in network management or information systems through program options.

Students are accepted into the program autumn term. Prior to entering the program, students shall demonstrate proficiency in keyboarding and basic computing skills, using word processing, spreadsheets, Internet software, and file management.

The University of Montana College of Technology is a Cisco Regional Training Center and a member of the Computer Technology Industry Association (Comp TIA). Opportunities exist for professional certification from Cisco (CCNA), Microsoft (MCT, MCSA), and Comp TIA (A+, Network+ and Security+).

Information Systems Management Option

The Information Systems Management option provides specialization in acquiring and supporting the software applications and hardware used in organizations. Students analyze, design, develop, implement, and support windows-based applications, database applications, and web-based applications. Business process is modeled and requirements defined for information technology resources.

Autumn Entry:

| First Year | A | S |
|-------------------------------------|---|---|
| BUS 103S Principles of Business | 3 | - |
| COM 160A Oral Communications | 3 | - |
| CSCI 105 (CRT 111) Computer Fluency | 3 | - |
| CRT 112 Operating Systems Fund | - | 3 |

| | | | | |
|---|----|---|----|---|
| CSCI 110 (CRT 121) Programming with Visual Basic I | - | | 3 | |
| CSCI 215E (CRT 122E) Social and Ethical Issues in CS | - | | 3 | |
| ITS 150 (CRT 151) CCNA - 1: Exploration | - | | 3 | |
| CSCI 172 (CRT 172) Introduction to Computer Modeling | - | | 3 | |
| M 115 (MAT 117) Probability and Linear Mathematics | 3 | | - | |
| WRIT 101 (WTS 101) College Writing I | 3 | | - | |
| Total | 15 | | 15 | |
| Second Year | | A | | S |
| ACTG 101 (ACC 132T) Accounting Procedures I | 4 | | - | |
| CSCI 221 (CRT 203) Systems Analysis and Design | - | | 3 | |
| ITS 210 (CRT 210T) Network Operating System - Desktop | 3 | | - | |
| CSCI 120 (CRT 231) Programming with Visual Basic II | 3 | | - | |
| CRT 263 Web Design and Development | - | | 3 | |
| CSCI 240 (CRT 275) Databases and SQL | 3 | | - | |
| ITS 280 (CRT 285T) Computer Repair and Maintenance | 3 | | - | |
| ITS 291 (CRT 289T) Special Topics | - | | 1 | |
| ITS 298 (CRT 290T) Internship/Cooperative Education | - | | 2 | |
| Directed Electives | - | | 6 | |
| Total | 16 | | 15 | |

Directed Electives Options:

- ACTG 201 (ACC 133T) Principles of Financial Accounting

- BUS 125T Principles of Marketing
- BUS 135T Business Law
- BUS 243T Psychology of Management and Supervision
- BUS 250T Entrepreneurship
- WRIT 121 (WTS 115) Introduction to Technical Writing
- COM 150S Interpersonal Communications

Network Management Option

The Network Management option provides specialization for supporting computing in a networking environment. Students install, configure, monitor, troubleshoot, and manage network connectivity, server-based computing systems, and intranetworking technologies.

Autumn Entry:

| First Year | | A | | S |
|---|-----------|---|-----------|---|
| BUS 103S Principles of Business | 3 | | - | |
| CSCI 105 (CRT 111) Computer Fluency | 3 | | - | |
| CRT 112 Operating Systems Fund | - | | 3 | |
| CSCI 110 (CRT 121) Programming with Visual Basic I | - | | 3 | |
| CSCI 215E (CRT 122E) Social and Ethical Issue in CS | - | | 3 | |
| ITS 150 (CRT 151) CCNA 1: Exploration | 3 | | - | |
| ITS 152 (CRT 152T) CCNA 2: Exploration | - | | 3 | |
| CSCI 172 (CRT 172) Introduction to Computer Modeling | - | | 3 | |
| M 115 (MAT 117) Probability and Linear Mathematics | 3 | | - | |
| WRIT 101 (WTS 101) College Writing I | 3 | | - | |
| Total | 15 | | 15 | |
| Second Year | | A | | S |
| COM 160A Oral Communications | - | | 3 | |
| ITS 210 (CRT 210T) Network Operating System - Desktop | 3 | | - | |

| | | |
|--|----|----|
| ITS 212 (CRT 215T) Network Operating System - Server Admin | 3 | - |
| ITS 214 (CRT 216T) Network Operating System - Infrastructure | - | 3 |
| ITS 222 (CRT 222T) Enterprise Security Seminar | - | 3 |
| CSCI 120 (CRT 231) Programming with Visual Basic II | 3 | - |
| ITS 250 (CRT 251T) CCNA 3: Exploration | 3 | - |
| ITS 252 (CRT 252T) CCNA 4: Exploration | - | 3 |
| ITS 280 (CRT 285T) Computer Repair and Maintenance | 3 | - |
| ITS 291 (CRT 289T) Special Topics | - | 1 |
| ITS 298 (CRT 290T) Internship/Cooperative Education | - | 2 |
| Total | 15 | 15 |

A student may request substitution of other courses in the areas of Business, Communication, or Information Technology to fulfill the directed elective requirement provided a clear connection can be made between a course, a student's career objective, and the degree program. All substitution requests require departmental approval.

Computer Support - Certificate of Applied Science

Students graduating with the Computer System Technician certificate will be able to install, configure, troubleshoot, repair, update, and support client-based personal computer operating systems, personal computer hardware, and basic network and Internet connectivity issues. They will define and apply basic information security practices, safety procedures, and environmental practices.

| First Year | S | A |
|--|---|---|
| BUS 103S Principles of Business | - | 3 |
| CSCI 105 (CRT 111) Computer Fluency | 3 | - |
| CRT 112 Operating Systems Fund | 3 | - |
| ITS 150 (CRT 151) CCNA 3 1: Exploration | - | - |

| | | |
|--|----|----|
| ITS 210 (CRT 210T) Network Operating Systems - Desktop | - | 3 |
| CSCI 110 (CRT 121) Programming with Visual Basic I | - | 3 |
| CSCI 172 (CRT 172) Introduction to Computer Modeling | - | 3 |
| ITS 280 (CRT 285T) Computer Repair and Maintenance | - | 3 |
| ITS 291 (CRT 289T) Special Topics | - | 1 |
| M 115 (MATH 117) Probability and Linear Math | 3 | - |
| WRIT 101 (WTS 101) College Writing I | 3 | - |
| Total | 15 | 16 |

Electronics Technology - Associate of Applied Science

Steven Rice, Director

Students in the Electronics Technology program learn to troubleshoot, calibrate, test, and repair electronic components and circuit boards used in a wide range of electronic equipment including computers and communication equipment. Training includes working knowledge of direct and alternating current theory, semiconductor circuits, instrumentation, automatic controls, data communications, computerized communication links, and operational amplifiers. Students become familiar with robotics, electronic communications theory, and modes of RF communications.

Students are awarded the Associate of Applied Science degree upon successful completion of the program. Students may enter autumn semester only.

| First Year | A | S |
|---|---|---|
| CSCI 105 (CRT 111) Computer Fluency | 3 | - |
| CRT 112 Operating Systems Fund | - | 3 |
| EET 111 Basic Electronics | 4 | - |
| EET 112 Electronics Lab I | 3 | - |
| EET 113 Circuits Lab | 1 | - |
| EET 121 Semiconductors | - | 4 |
| EET 122 Electronics Lab II | - | 3 |
| EET 123 Amplifier and Power Supply Lab | - | 1 |

| | | | |
|--|----|----|-----|
| M 151 (MAT 120) Precalculus | 4 | - | |
| M 162 (MAT 145) Applied Calculus | - | 4 | |
| PSYX 161S (PSY 110S) Fund of Organizational Psychology | - | 3 | |
| WRIT 121 (WTS 115) Introduction to Technical Writing | 3 | - | |
| Total | 18 | 18 | |
| Second Year | | | A S |
| EET 227 Digital Electronics | 4 | - | |
| EET 234T Automatic Controls | 4 | - | |
| EET 240T Robotics | - | 3 | |
| EET 241T Instrumentation | - | 3 | |
| EET 242T Electronics Lab III | - | 3 | |
| EET 260 Data Communications | - | 3 | |
| EET 270T Wireless Communications | 4 | - | |
| EET 280T Electronics Capstone | - | 2 | |
| SCN 120T-121T Technical Physics I, II | 4 | 4 | |
| Total | 16 | 18 | |

Energy Technology - Associate of Applied Science

Students in the Energy Technology program are introduced to the full suite of energy sources and technologies. Graduates are general practitioners equipped with skills in: design, installation, and maintenance of diverse energy technologies and systems; sales, operations, and management; regulatory compliance; basic electricity and power systems; energy storage and distribution; site assessment; basic energy economics; efficiency and conservation strategies; project management. Students may enter the program autumn or spring term. Further information can be found at <http://ace.cte.umt.edu/energy/>

| | | | |
|---------------------------------------|---|---|-----|
| First Year | | | A S |
| BUS 160S Issues in Sustainability | 3 | - | |
| NRG 235 Building Energy Efficiency | - | 3 | |

| | | |
|---|----|---------|
| CSCI 172 (CRT 172) | 3 | - |
| Introduction to Computer Modeling | | |
| EET 111 Basic Electronics | - | 4 |
| EET 112 Electronics Lab I | - | 3 |
| M 121 College Algebra | - | 3 |
| NRG 101 Introduction to Energy Systems I | 3 | - |
| NRG 102 Introduction to Energy Systems II | - | 3 |
| SCN 175N Integrated Physical Science | 3 | - |
| WRIT 101 (WTS 101S) College Writing I | 3 | - |
| Total | 15 | 16 |
| Summer Session | | Credits |

| | |
|-------------------------------------|---|
| NRG 191 Energy Practicum (60 Hours) | 2 |
| Total | 2 |

| | | | |
|---|----|----|---|
| Second Year | | A | S |
| BUS 103S Principles of Business | - | 3 | |
| CRT 209T Project Management | 3 | - | |
| EVST 101 Environmental Science | 3 | - | |
| M 122 College Trigonometry | 3 | - | |
| NRG 213 Power Systems Technology | 3 | - | |
| NRG 298 Energy Internship | - | 2 | |
| NRG 214 Energy Storage and Distribution Systems | - | 3 | |
| Select 5 Energy Electives (see list below) | 6 | 9 | |
| Total | 18 | 17 | |

Energy Elective Requirement: Students must select a total of 5 energy related electives or 4 energy related electives and 1 general elective.

Energy-Related Electives:

- GEO191 (GEOS 195) Special Topics: Fossil Fuels (3 cr)
- NRG 241 Alternative Fuels (3 cr)
- NRG 242 Solar and Wind and Energy Systems (3 cr)
- NRG 243 Fundamentals of Photovoltaic Design and Installation (3 cr)
- NRG 244 Bioenergy (3 cr)
- NRG 245 Fuel Cells (3 cr)

- NRG 295 Special Topics

General Electives

- BUS 135T Business Law (3 cr)
- BUS 250T Entrepreneurship (3 cr)
- CSTN 276 (CAR 236T) Building for Solar Energy (3 cr)
- CSTN 277 (CAR 240T) Alternative Construction Materials (3 cr)
- COM 150S Interpersonal Communications (3 cr)
- COM 160A Oral Communications (3 cr)
- CSCI 105 (CRT 111) Computer Fluency (3 cr)
- CADX 110 (CRT 182) Intro to Computer Aided Design (2 cr)
- EET 234T Automatic Controls (4 cr)
- EET 241T Instrumentation (3 cr)
- NRG 295 Special Topics: Energy Choices and Sustainability (3 cr)
- PSYX 162 Organizational Psychology (3 cr)
- SCN 120T Technical Physics I* (3 cr)
- SCN 121T Technical Physics II* (3 cr)

*Completion of both can be considered in lieu of SCN 175N Integrated Physical Science (3 cr)

Accounting Technology-A.A.S. degree

Computer Support Option

Students interested in a career which prepares them to work as accounting technicians with a specialty in information technology may select the Accounting Technology, Computer Support option. This program is detailed in the Business Technology Department section of this catalog.

Courses

Computer Aided Design (CADX)

U 110 (CRT 182T) Intro to Computer Aided Design 2 cr. Offered autumn. Prereq., CAPP 120 (CRT 100) or demonstrated computer experience. An introduction to computer aided design and drafting software for production of drawings and plans for architecture and engineering systems. Fundamentals of two dimensional drafting and drawing management for professional design.

U 131 Technical Graphics 3 cr. An introduction to the techniques and standard practices of communicating technical graphics. The class studies and practices drawing skills and learns the drawing standards that support the needs of the design team in advancing ideas. It also provides the foundation for successful drawing communication in the CAD environment. Topics covered include; drawing media and tools, hand drawing skills, perspectives, views, sketching, standard scales, geometric construction, sections, dimensioning, and tolerances.

U 142 (CRT 175) Geospatial Technologies 3 cr. Offered Spring. Basics of geospatial technologies; remotely sensed imagery, GIS, and GPS and how each of the individual

areas can be used together to analyze spatial datasets. Students will explore a wide range of spatial data and will learn to apply these data sets to real-world solutions.

U 156 Computer Aided Design II 3 cr. Prereq. CADX 110 (CRT 182T). CAD II provides a project-based, in-depth study of the skills and concepts involved in Computer Aided Design and Drafting. Topics covered included object grouping and sharing; three dimensional modeling; animation; and interoperability with other software. This course is the second in a two-part series covering the core AutoCAD application.

U 195 Special Topics (1-6) cr. (R-6) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

U 212 (CRT 184) Civil Design Technologies 4 cr. Offered spring. prereq. CADX 110 (CRT 182T). Introduces students to computer aided design software for common survey and engineering design and drafting applications. Topics include collection of survey data; the coordinate geometry system; surfaces; subdivision and land planning; road design and corridor modeling; utilities; site grading and drainage; mapping; and 3D visualization.

Computer Applications (CAPP)

U 120 (CRT 100) Introduction to Computers 3 cr. Offered autumn and spring. Introduction to computer terminology, hardware, and software, including wire/wireless communications and multimedia devices. Students utilize word processing, spread sheet, database, and presentation applications to create projects common to business and industry in a networked computing environment. Internet research, email usage, and keyboarding proficiency are integrated.

U 154 (CRT 108) MS Word 3 cr. Offered autumn and spring. Prereq., CAPP 120 (CRT 100) or basic computer experience and consent of instr. Preparation of business forms, correspondence, mail merges, columnar projects, and reports using up-to-date software. Business related application projects, graphics, and printer operation are included.

U 156 (CRT 180T) MS Excel 3 cr. Offered autumn and spring. Prereq., CAPP 120 (CRT 100) or 103T; and M 090 (MAT 005D) or M 095 (MAT 100D). Emphasis on the use of workbooks and sheets to solve business problems. Includes projects relating to data and graphs/charts.

U 254 (CRT 115) Advanced MS Word 3 cr. Offered autumn and spring. Prereq., CAPP 154 (CRT 108). Analysis of the concepts of advanced word processing document production underlying mastery of the software. Business-related application projects utilizing critical thinking included. Speed and timing component to increase skills essential for employment.

Computer Science/Programming (CSCI)

U 105 (CRT 111) Computer Fluency 3 cr. Offered autumn and spring. Prereq., CAPP 120 (CRT 100) or demonstrated computing experience. Introduces the skills and concepts of information technology, both from practical and a more theoretical point of view. During lectures and interactive computer labs, students will explore a wide range of digital and information technologies, including common PC applications, networking,

databases, privacy, and security. Credit not allowed for both CSCI 105 and CRT 111 and CS 111.

U 110 (CRT 121) Programming with Visual Basic I 3 cr. Offered autumn and spring. Prereq., M 095 (MAT 100D) and demonstrated computing experience. An introduction to object-oriented programming using an even-driven paradigm. Basic concepts of control structures, data handling, documentation, and error control. Fundamentals of algorithm design and structured software development.

U 113 (CRT 270) Programming with C++ I 3 cr. Offered intermittently. Prereq., CSCI 110 (CRT 121). Object oriented programming using C++. Implementation of structured programming concepts along with construction of classes to create data types for defining objects.

U 120 (CRT 231) Programming with Visual Basic II 3 cr. Offered autumn. Prereq., CSCI 110 (CRT 121). Design and implementation of software using College of Technology Department of Applied Computing and Electronics 223 object-oriented programming practices. The class framework is used to apply the object-oriented techniques of encapsulation, polymorphism, and inheritance.

U 172 (CRT 172) Introduction to Computer Modeling 3 cr. Offered autumn and spring. Prereq., CAPP 120 (CRT 100) or demonstrated computing experience. Problem solving and data modeling using computer productivity software. Emphasis using spreadsheets and databases for data analysis. Formal presentation of results. Credit not allowed for both CSCI 172 and CRT 172 and CS 172.

U 191 (CRT 195T) Special Topics 1-6 cr. (R-6) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

U 192 (CRT 196T) Independent Study Variable cr. (R-6)

U 215E (CRT 122E) Social and Ethical Issues in CS 3 cr. Offered spring. Prereq., WRIT 101 (WTS 101). Exploration of ethical issues in the field of computing. Skills needed to identify and analyze various ethical concerns. Standard ethical concepts and theories, methods of ethical analysis. Strong emphasis on practical application of the ethical process.

U 221 (CRT 203) Systems Analysis and Design 3 cr. Offered spring. Prereq., CSCI 172 (CRT 172). Analysis of the system development life cycle. Emphasis on planning, analyzing, designing, implementing and supporting information systems to meet business requirements. Covers feasibility studies, time and cost estimates, modeling tools, design tools, implementation and support strategies. A simulated business design project will be developed.

U 240 (CRT 275) Database and SQL 3 cr. Offered autumn. Prereq., CSCI 172 (CRT 172) or consent of instr. Relational database design including: requirements analysis, data structure, entity relationships, normalization, relational algebra and integrity. Physical implementation focusing on data storage; retrieval and modification; concurrency; optimization; security; SQL; and XML.

Computer Technology CRT

U 112 Operating System Fund 3 cr. Offered spring. Prereq. CAPP 120 (CRT 100) or demonstrated computing experience. Introduction to operating system concepts through the use of contemporary software. Emphasizes file system management, networking, installation, maintenance, management, and disaster recovery practices

using both the command interpreter and graphical user interface. Offered intermittently. Prereq., CAPP 120 (CRT 100). Basics of using a current database software package to solve business problems.

U 188T Computers and Law 3 cr. Offered autumn. Prereq., CAPP 120 (CRT 100) and LEG 185T. Intermediate concepts of computer systems, operating systems, graphical environments, electronic mail, Internet, and file management. A variety of applications including word processing, spreadsheet, database, presentation, and law-related software are included.

U 205T Food Service Management Computer Applications 2 cr. Offered spring. Prereq., CAPP 120 (CRT 100). Introduction to computerized applications relevant to the food service industry. Includes spreadsheet, recipe management and word processing software; appropriate industry reports, create menus and fliers; import, export and scale recipes; analyze nutrition; and calculate food cost.

U 209T Project Management 3 cr. Offered intermittently. Prereq., CSCI 172 (CRT 172). Investigation of topics in project management including scope, definition, risk, procurement and the RFP. Management of time, cost, quality, and human resources. Concepts are reinforced with PM software.

U 260 Digital Publishing and Design 3 cr. Offered autumn and spring. Prereq., CAPP 120 (CRT 100) or 103T or consent of instr. A comprehensive foundation of layout and design principles to integrate digital media essential for effective print-based and web-based business publications.

U 263 Web Design and Development 3 cr. Offered autumn and spring. Prereq., CAPP 120 (CRT 100) or consent of instr. Provides a background and foundation skills required for designing and implementing Web sites for public and private organizations. Marketing and design techniques are applied using state-of-the-art software.

Electronics Technology (EET)

U 111 Basic Electronics 4 cr. Offered autumn. Study of current flow, direct current circuits, alternating current circuits, and concepts of power. The introduction of time-varying currents and impedances using circuit analysis and problem solving techniques.

U 112 Electronics Lab I 3 cr. Offered autumn. Coreq., EET 111. The use of basic electronic test instruments and troubleshooting. Building circuits using resistive, capacitive and inductive components.

U 113 Circuits Lab 1 cr. Offered autumn. Coreq., EET 111. Covers proper techniques of soldering and tool usage. Electronic technical language, hands on troubleshooting skills and basic electronic measurements are involved.

U 121 Semiconductors 4 cr. Offered spring. Prereq., EET 111, 112. Coverage of diode, bipolar transistors and field effect transistor circuits used in electronic applications. The study and analysis of the components and circuits used in semiconductor electronics and an introduction to operational amplifiers.

U 122 Electronics Lab II 3 cr. Offered spring. Coreq., EET 121. Bread-boarding, troubleshooting and measuring the electronic characteristics of diodes, bi-polar transistors, JFETS and operational amplifiers. The impact of impedance matching, filtering and power effects on stages of electronic circuits will be covered.

U 123 Amplifier and Power Supply Lab 1 cr. Offered spring. Coreq., EET 121. An audio amplifier and dual regulated power supply will be built throughout the semester.

U 195T Special Topics 1-6 cr. (R-6) Offered Intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

U 227 Digital Electronics 4 cr. Offered autumn. Prereq., EET 103. Explores digital electronic circuits and devices that make up a computer system. Topics include binary and hexadecimal number systems, Boolean algebra and digital logic theory, simple logic circuits, combinational logic, and sequential logic. Also covered is the analog-to-digital and digital-to-analog interfaces between a digital system and the real (analog) world. Includes hands-on labs.

U 232 Microprocessors 4 cr. Offered spring. Prereq., EET 227. Explores microprocessor architecture, design, and operations; machine language and assembly language programming; hardware input/output interfacing; and design applications. Includes hands-on labs incorporating an individual student trainer based on the Intel 8085A microprocessor.

U 234T Automatic Controls 4 cr. Offered autumn. Prereq., EET 227. Explores the theory, terminology and components used in automatic control of industrial machines and processes. Uses the servomechanism as a representative control system to analyze open-loop, closed-loop, proportional, integral, and differential control strategies. The use of transducers and computers in automatic control systems in the industrial control setting is emphasized.

U 240T Robotics 3 cr. Offered spring. Prereq. or coreq., EET 232, EET 234T or consent of instr. Explores physical and operating characteristics of a robot. Topics include robot configurations, power supplies, control systems, end effectors, sensors, stepper motors and stepper controls. Robot programming also is covered and a typical robot is programmed to perform repetitive actions. Includes hands-on labs.

U 241T Instrumentation 3 cr. Offered spring. Prereq., EET 227T. The study and analysis of industrial measuring and process control instrumentation in both analog and digital form. Proper selection, use and interpretation of measurement equipment and data.

U 242T Electronics Lab III 3 cr. Offered spring. Coreq., EET 241T Bread-boarding, building, repairing and troubleshooting electronic circuits using the equipment normally found in an electronic shop. Correlating measurement information in solving electronic problems.

U 260 Data Communications 3 cr. Offered autumn. Prereq., EET 103T. Explores the principles, applications, and theory of data communication systems. Topics include communication concepts and terminology, analog and digital channel characteristics, signaling techniques for analog and digital data, communication codes, transmission media, and standards and protocols for various data communication systems including computer networks, and the public switched telephone network. Includes hands-on labs.

U 270T Wireless Communications 4 cr. Offered autumn. Prereq., EET 103T. Explores audio and radio frequency (RF) circuits. Topics include AM and FM signal modulation and demodulation, RF transmitters, RF receivers, RF amplifiers, audio amplifiers, oscillators, mixers, and antennas. Includes hands-on labs.

U 280T Electronics Capstone 2 cr. Offered spring. Prereq., EET 227T. Completion of project prototypes. Includes comprehensive final project from conception to market.

U 295T Special Topics 1-6 cr. (R-6) Offered Intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

U 298 Internship 2 cr. Offered intermittently. Consent of instructor required. Extended classroom experience providing practical application of classroom learning through on the job training in a student's field of study. This experience increases student skills, prepares them for initial employment, and increases occupational awareness and professionalism.

Energy Technology (NRG)

U 101 Introduction to Energy Systems I 3 cr. Offered autumn and spring. A survey of traditional energy systems and technologies. Introduces conventional primary energy sources--coal, oil, gas, nuclear--and examines the technologies used to capture, convert, distribute, store, and utilize these energy sources. Consideration is given to physical and engineering aspects, as well as economic, social environmental, and political factors that determine the sustainability of these sources.

U 102 Introduction to Energy Systems II 3 cr. Offered autumn and spring. Prereq., NRG 101 or consent of instructor. Same as CCS 102. A survey of renewable energy systems and technologies. Addresses physical and technical aspects of wind, solar, geothermal, hydro, tidal, biological, and wave energy systems. Consideration is given to engineering, economic, social, environmental, and political factors that determine implementation and sustainability. Credit not allowed for both NRG 102 and CCS 102.

U 191 Practicum 2 cr. Offered summer only. Prereq., consent of instructor. Same as CCS 191. The practicum provides students with a supervised field experience. Students will gain hands-on experience with energy specific technologies. This opportunity increases students' occupational awareness and professionalism.

U 195 Special Topics 1-6 cr (R-6) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

U 196 Independent Study 1-6 (R-6) Offered intermittently.

U 213 Power Systems Technology 3 cr. Offered autumn. A review of the principles of electricity, magnetism, and transformer action; the application of these principles in the operation of single-phase and three-phase ac/dc motors, alternators, and generators; and the control methods for these electrical devices.

U 214 Energy Storage and Distribution Systems 3 cr. Offered spring. Prereqs., EET111 and NRG 213, or consent of instructor. Studies storage and transport methods of different types of energy. Explores emergent technologies and mechanisms designed to enhance efficiency and safety, including 'smart grid' technologies; assesses relative social, economic and environmental merits of each type of energy system in terms of its storage and distribution.

U 235T Building Energy Efficiency 3 cr. Offered spring. Provides an overview of energy efficiency opportunities in residential buildings and prepares the student to take the National RESNET Home Energy Rater Exam. Familiarity with residential construction and basic energy terminology is useful though not required.

U 241 Alternative Fuels 3 cr. Offered autumn. Identifies alternative fuel sources; explores fuel characteristics; identifies and evaluates the infrastructure required

to produce, store, distribute, and use them; discusses emission and conversion efficiencies; assesses social, environmental, and economic impacts.

U 242 Solar and Wind Systems 3 cr. Offered spring. Same as CCS 242. Introduction to the fundamentals of solar and wind energy for the design and installation of solar and wind systems. Includes an overview of the physics and chemistry of the resource and the technology, and will prepare students for a career in renewable energy or for installing a renewable energy system on their own home. Credit not given for NRG 242 and CCS 242.

U 243 Fundamentals of Photovoltaic Design and Installation 3 cr. Offered spring. Prereq./coreq., EET111 Basic Electronics. An introduction to the fundamental principles and technologies of solar photovoltaic energy systems. Emphasis on system design and installation, including site and resource assessment, load analysis, trouble shooting, and cost analysis. The material covered prepares students for a career in renewable energy or for installing a renewable energy system on their own home.

U 244 Bioenergy 3 cr. Offered autumn. Prereqs., SCN175N and NRG102, or consent of instructor. Investigates the physical nature of various biorenewable resources and the technologies currently employed to produce, harvest, refine and convert these into useable energy, feedstocks and products.

U 245 Fuel Cells 3 cr. Offered spring. An introduction to the different types of fuel cells (hydrogen, biological, metal/air, proton exchange membrane, etc.) accompanied by a critical examination of their applications, operation, efficiencies, advantages and disadvantages.

U 290 Internship 2 cr. Offered spring. Consent of instructor required. Same as CCS 290. Students complete a field experience at an energy-related site or in an energy-related industry. A series of career development seminars and activities related to the field experience are completed in parallel.

U 295 Special Topics 1-6 cr. (R-6) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

U 296 Independent Study 1-6 cr. (R-6) Offered intermittently.

U 298 Internship 2 cr. Offered every term. Consent of instructor required. Same as CCS 298. Extended classroom experience providing practical application of classroom learning through on the job training in a student's field of study. This experience increases student skills, prepares them for initial employment, and increases occupational awareness and professionalism.

Information Technology Systems (ITS)

U 150 (CRT 151) CCNA 1: Exploration 3 cr. Offered autumn and spring. Prereq., CAPP 120 (CRT 100) or demonstrated computer experience. Introduction to networking field including terminology; protocols; local-area and wide-area networks; the OSI model; topologies; IP addressing; cabling and cabling tools; routers and router programming; Ethernet and network standards; and wireless technologies.

U 152 (CRT 152T) CCNA 2: Exploration 3 cr. Offered spring. Prereq., ITS 150 (CRT 151) and CRT 112 or consent of instr. Covers router theory and technologies including configurations, IOS software management, routine protocol configuration, TCP/IP, access-lists and introduction to LAN switching.

U 210 (CR 210T) Network Operating System - Desktop 3 cr. Offered autumn. Prereq., CRT 112, ITS 150 (CRT 151). In-depth study of a secure, multi-user, client-based network operating system. Topics include installation, administration of resources, performance, network services, and security.

U 212 (CRT 215T) Admin 3 cr. Offered autumn. Prereq., CRT 112, ITS 150 (CRT 151). Server technologies commonly used in local area networking. Topics include installation, administration, storage, application services, network services, security, reliability, and availability.

U 214 (CRT 216T) Infrastructure 3 cr. Offered spring. Prereq., ITS 210 (CRT 210T). Principles and implementation of enterprise networking services. Topics include Protocol Binding, DNS, DHCP, WINS, Remote Access, IP Routing, IP Security, Network Address Translation, and Certificate Services.

U 222 (CRT 222T) Enterprise Security 3 cr. Offered spring. Prereq., ITS 210 (CRT 210T). Examination of general information technology security concepts. Topics include access control, authentication, attack methods, remote access, web security, wireless networks, cryptography, internal infrastructure security, and external attacks. Security procedures, organizational policies, risk management and disaster recovery addressed.

U 250 (CRT 251T) CCNA 3: Exploration 3 cr. Offered autumn. Prereq., ITS 152 (CRT 152T). Covers router configurations including advanced IP addressing techniques, variable length subnet masking, intermediate routing protocols, Ethernet switching, virtual LANs, spanning-tree protocol, and VLAN trucking protocol.

U 252 (CRT 252T) CCNA 4: Exploration 3 cr. Offered spring. Prereq., ITS 250 (CRT 251T). Project-based course in wide-area networking including advanced IP addressing techniques, network address translation, port address translation, DHCP, WAN technology and terminology, PPP, ISDN, DDR, Frame Relay, network management, and introduction to optical networking.

U 255 (CRT 295T) IP Telephony 1-6 cr. (R-6) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

U 280 (CRT 285T) Computer Repair and Maintenance 3 cr. Offered autumn. Prereq., CRT 103T, CRT 112. In-depth study of personal computer hardware. Focus on field replaceable components. Topics include: storage devices, processors, system boards, memory, ports, cabling, power supplies, multimedia devices, printers, and troubleshooting.

U 291 (CRT 289T) Speical Topics 1 cr. Offered spring. Prereq., consent of instr. Review objectives of an information technology industry-based professional certification. Certification objectives, preparation strategies, and exam strategies included. Course can be repeated for different industry-based professional certifications.

U 298 (CRT 290T) Internship/Cooperative Education 2 cr. Offered autumn and spring. Prereq., last semester in program, minimum of "C" in all CSCI/ITS (CRT) courses, and approval of program director. Not open to non-majors. On-the-job training in positions requiring information technology competencies. This experience increases students' skills, prepares them for initial employment, and increases occupational awareness and professionalism. Students work a minimum of six hours each week at an approved site and attend a weekly one-hour seminar.