

2009-2010 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 dynamic global society. 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

Thomas Gallagher, Director

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 |
| CRT 111 Fluency in Information Technology | 3 | - |
| CRT 182T Computer Aided Design I | 2 | - |
| CRT 195 Special Topics: Computer Aided Design II | 3 | - |
| CRT 195 Special Topics: Graphics Communication | 3 | - |
| CRT 172 Introduction to Computer Modeling | - | 3 |
| CRT 175 Geospatial Technologies | - | 3 |

| | | |
|--------------------------------------|----|----|
| CRT 184 Civil Design Technologies | - | 4 |
| 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-A.A.S. Degree

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+).

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 | - | |
| CRT 111 Fluency in Information Technology | 3 | - | |
| CRT 112 Operating System Fundamentals | - | 3 | |
| CRT 121 Introduction to Programming | - | 3 | |
| CRT 122E Ethics and Information Technology | - | 3 | |

| | | | |
|--|----|----|-----|
| CRT 151 Networking Basics | 3 | - | |
| CRT 152T Routers and Router Basics | - | 3 | |
| 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 | |
| CRT 210T Advanced Operating Systems | 3 | - | |
| CRT 215T Server Technologies | 3 | - | |
| CRT 216T Network Infrastructure | - | 3 | |
| CRT 222T Security Seminar | - | 3 | |
| CRT 231 Object-Oriented Programming | 3 | - | |
| CRT 251T Switching Basics and Intermediate Routing | 3 | - | |
| CRT 252T WAN Technologies | - | 3 | |
| CRT 285T PC Hardware Support | 3 | - | |
| CRT 289T Professional Certification | - | 1 | |
| CRT 290T Computer Technology Internship | - | 2 | |
| Total | 15 | 15 | |

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 | - | |
| CRT 111 Fluency in Information Technology | 3 | - | |
| CRT 112 Operating System Fundamentals | - | 3 | |
| CRT 121 Introduction to Programming | - | 3 | |
| CRT 122E Ethics and Information Technology | - | 3 | |
| CRT 151 Networking Basics | - | 3 | |
| 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 | - | |
| CRT 203 Systems Analysis | - | 3 | |
| CRT 210T Advanced Operating Systems | 3 | - | |
| CRT 231 Object-Oriented Programming | 3 | - | |
| CRT 263 Web Design and Development | - | 3 | |
| CRT 275 Database Design and Implementation | 3 | - | |
| CRT 285T PC Hardware Support | 3 | - | |
| CRT 289T Professional Certification | - | 1 | |
| CRT 290T Computer Technology Internship | - | 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

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 System Technician 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 |
| CRT 111 Fluency in Information Technology | 3 | - |
| CRT 112 Operating System Fundamentals | 3 | - |
| CRT 151 Networking Basics | 3 | - |
| CRT 210T Advanced Operating Systems | - | 3 |
| CRT 121 Introduction to Programming | - | 3 |
| CRT 172 Introduction to Computer Modeling | - | 3 |
| CRT 285T PC Hardware Support | - | 3 |
| CRT 289T Professional Certification A+ | - | 1 |
| M 095 (MAT 100D) Intermediate Algebra | 3 | - |
| WRIT 101 (WTS 101) College Writing I | 3 | - |
| Total | 15 | 16 |

Electronics Technology-A.A.S. Degree

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 |
|--|----|----|
| CRT 111 Fluency in Information Technology | 3 | - |
| CRT 112 Operating Systems Fundamentals | - | 3 |
| EET 111 Basic Electronics | 4 | - |
| EET 112 Electronics Lab I | 3 | - |
| EET 113 Circuits Kit | 1 | - |
| EET 121 Semiconductors | - | 4 |
| EET 122 Electronics Lab II | - | 3 |
| EET 123 Amplifier Kit | - | 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-A.A.S. Degree

Ashley Preston, Director

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 | - |
| CAR 235 Building Energy Conservation | - | 3 |
| CRT 172 Introduction to Computer Modeling | 3 | - |
| 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 Sciences | 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 |

| | | |
|---|----|----|
| CAR 209T Project Management | 3 | - |
| EVST 101 Environmental Science | 3 | - |
| M 122 College Trigonometry | 3 | - |
| NRG 213 Power Systems Technology | 3 | - |
| NRG 290 Energy Internship | - | 2 |
| NRG 295 Special Topics: 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 Special Topics: Fossil Fuels (3 cr)
- NRG 241 Alternative Fuels (3 cr)
- NRG 242 Solar and Wind and Energy Systems (3 cr)
- NRG 295 Special Topics: Fuel Cells (3 cr)
- NRG 295 Special Topics: Bioenergy (3 cr)
- NRG 295 Special Topics: Fundamentals of Photovoltaic Design and Installation (3 cr)
- NRG 295 Special Topics: Introduction to Geothermal Energy Systems (3 cr)

General Electives

- BUS 135T Business Law (3 cr)
- BUS 250T Entrepreneurship (3 cr)
- CAR 236T Building for Solar Energy (3 cr)
- CAR 240T Alternative Construction Materials (3 cr)
- COM 150S Interpersonal Communications (3 cr)
- COM 160A Oral Communications (3 cr)
- CRT 111 Fluency in Information Technology (3 cr)
- CRT 182 Computer Aided Design and Drafting (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 Applications (CAPP)

U 115 (CRT 115T) MS Word 3 cr. Offered autumn and spring. Prereq., CAPP 134 (CRT 108). Analysis of the concepts of advanced work 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.

U CAPP 120 (CRT 100) Introduction to Computers 2 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 CAPP 134 (CRT 108) Basic MS Word 2 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 CAPP 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.

Computer Technology (CRT)

U 111 Fluency in Information Technology 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 CRT 111 and CS 111.

U 112 Operating System Fundamentals 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.

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

U 122E Ethics and Information Technology 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 151 Networking Basics 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 152T Routers and Routing Basics 3 cr. Offered spring. Prereq., CRT 151 and CRT 112T 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 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 CRT 172 and CS 172.

U 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 181T Introduction to Database Software 2 cr. Offered intermittently. Prereq., CAPP 120 (CRT 100). Basics of using a current database software package to solve business problems.

U 182T Computer Aided Design and Drafting 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 184 Civil Design Technologies 4 cr. Offered spring. prereq. 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.

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

U 203 Systems Analysis 3 cr. Offered spring. Prereq., 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 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., 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 210T Advanced Operating Systems 3 cr. Offered autumn. Prereq., CRT 112T, 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 215T Server Technologies 3 cr. Offered autumn. Prereq., CRT 112T, CRT 151. Server technologies commonly used in local area networking. Topics include installation, administration, storage, application services, network services, security, reliability, and availability.

U 216T Network Infrastructure 3 cr. Offered spring. Prereq., 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 222T Security Seminar 3 cr. Offered spring. Prereq., 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 231 Object-Oriented Programming 3 cr. Offered autumn. Prereq., 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 251T Switching Basics and Intermediate Routing 3 cr. Offered autumn. Prereq., 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 trunking protocol.

U 252T WAN Technologies 3 cr. Offered spring. Prereq., 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 255T Advanced Routing 3 cr. Offered intermittently. Prereq., consent of instr. Analysis, design, and implementation of inter-network routing techniques. Topics include scalability, routing protocols, optimization, and security.

U 256T Remote Access 3 cr. Offered intermittently. Prereq., consent of instr. Analysis, design, and implementation of remote access technologies including connectivity, access control, bandwidth utilization, fault tolerance, redundancy, and integrity.

U 257T Multilayer Switching 3 cr. Offered intermittently. Prereq., consent of instr. Analysis, design, and implementation of reliable, scalable, multiplayer switched LANs. Topics include VLANs, switching protocols, routing, redundancy, multicasting, quality of service, security, and transparency.

U 258T Network Troubleshooting 3 cr. Offered intermittently. Prereq., consent of instr. Network troubleshooting using baselines, configuration documentation, and a building-block approach through analysis of each layer in the OSI networking model.

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.

U 270 C++ Programming 3 cr. Offered intermittently. Prereq., 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 275 Database Design and Implementation 3 cr. Offered autumn. Prereq., 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.

U 285T PC Hardware Support 3 cr. Offered autumn. Prereq., CRT 103T, CRT 112T. 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 289T Professional Certification 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 290T Computer Technology Internship 2 cr. Offered autumn and spring. Prereq., last semester in program, minimum of "C" in all 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.

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

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.

Energy Technology (NRG)

U 101 Introduction to Energy Systems I 3 cr. Autumn only. 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. Prereq., NRG 101 or consent of instructor. Spring only. 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. Autumn only. 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 241 Alternative Fuels 3 cr. Autumn only. 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. Spring only. 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 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.