

*Brian W. Raichle, Chair*

The Department of Sustainable Technology and the Built Environment has developed a reputation for teaching, research and development, and community service in the areas of green building practices, renewable energy, sustainability, and design for the human environment. The Department's mission is to foster a strong and vibrant culture of inquiry, discovery, and innovation that integrates theory with application, problem seeking with problem solving, local issues with global perspectives, and technological progress with environmental stewardship. This mission is accomplished by 1) providing exemplary teaching that inspires and challenges students through experiential learning, synergistic curricula, and community engagement; 2) conducting and disseminating scholarly work that focuses on sustainable solutions to important challenges in the design, creation, and management of technological systems; and 3) serving as a resource and a catalyst for local and global communities through projects, partnerships, and outreach.

## **Bachelor of Science degree in Sustainable Technology (571A/15.0507)**

**Bachelor of Science degree in Building Sciences (577\*/52.2001)** has three concentrations:

- **Concentration in Architectural Technology and Design (577B)**
- **Concentration in Construction Management (577C)**
- **Concentration in Sustainable Building Systems (577D)**

## **Minors in the Department of Sustainable Technology and the Built Environment**

Students not majoring in the Department of Sustainable Technology and the Built Environment may earn one of the following minors:

- **Sustainable Technology Minor (593/15.0612)**
- **Building Science Minor (580/52.2001)**

## **Honors Program in Sustainable Technology and the Built Environment**

The Department of Sustainable Technology and the Built Environment offers a 9 semester hour honors program composed of 6 semester hours of Sustainable Technology and the Built Environment honors courses (or honors contracts or graduate courses) and a 3 semester hour Sustainable Technology and the Built Environment honors thesis. To graduate with "Honors in Sustainable Technology and the Built Environment," a student must be a Sustainable Technology and the Built Environment major, maintain an overall GPA of 3.45, maintain an overall Sustainable Technology and the Built Environment GPA of 3.45, and earn a grade of no less than a "B" in any honors designated course.

## **Graduate Degrees in Sustainable Technology and the Built Environment**

The Department of Sustainable Technology and the Built Environment offers the following graduate degree: a Master of Science degree in Technology with concentrations in Appropriate Technology, Building Science, Renewable Energy Engineering, and Sustainable Design and Construction. Persons interested in this degree are requested to consult the Graduate Bulletin for further information.

## Courses of Instruction in Sustainable Technology and the Built Environment (TEC)

This catalog reflects fall and spring semester offerings. Go to [www.summerschool.appstate.edu](http://www.summerschool.appstate.edu) for courses offered in summer terms.

### TECHNOLOGY (TEC)

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#### **TEC 1017. Communications Technology (3).S.**

An introduction to the study of communication systems, including: electronic data communications; technical drawing and CADD; optics; graphic production techniques; photography; audio; and video. Classroom presentations and activities will emphasize the design, use and impacts of communication technologies. Lecture two hours, laboratory two hours.

#### **TEC 1023. Introduction to Electronics (3).On Demand.**

An introduction to electrical and electronic circuits. Topics included are Ohm's law, Kirchhoff's laws, power, DC circuits, network theorems, and an introduction to AC circuits and commonly used electronic components. Theory is reinforced by experiments employing power supplies, circuit components, analog and digital meters, and the oscilloscope. Lecture two hours, laboratory two hours. (ND Prerequisite: passing the math placement test or successful completion of MAT 0010.)

#### **TEC 1123. AC/DC Circuit Analysis (3). On Demand.**

An introduction to capacitance, magnetic circuits, inductance and AC circuit analysis methods. Topics included are transient behavior of currents and voltages, electric and magnetic fields, magnetic circuits, AC circuit analysis, resonance, and network theorems. Theory is reinforced by experiments employing signal generators, resistive and reactive circuit components, meters, and the oscilloscope. Lecture two hours, laboratory two hours. Prerequisite: TEC 1023. Prerequisite or co-requisite: MAT 1110. (ND Prerequisite: passing the math placement test or successful completion of MAT 0010.)

#### **TEC 1708. Construction Technology and Building Codes (3).F;S.**

This course provides students with an introduction to the construction process, building materials and designs, management issues, and building codes. Emphasis is given to contemporary trends in residential and commercial construction, with considerable focus on different building types, energy efficient and high performance buildings and building codes. The course includes a lab in which students are introduced to construction management techniques and participate in hands-on construction activities.

#### **TEC 1728. Architectural Graphics and Computer Modeling (3).F;S.**

Fundamentals of architectural graphics including basics of construction, sketching, architectural drafting conventions, CAD techniques, BIM techniques, pictorial drawing, dimensions, sections, and working drawings. Selected assignments from this course will be appropriate for inclusion in student portfolios. Lecture two hours, laboratory two hours. Prerequisite or co-requisite: TEC 1708 (Construction Technology and Building Codes).

#### **TEC 2012. Production Techniques in Graphic Arts (3). On Demand.**

Theory and application of different production techniques in photo offset lithography and auxiliary areas. The course will operate in the same manner as a commercial print shop. Lecture one hour, laboratory four hours.

#### **TEC 2029. Society and Technology (3).F;S.**

*GEN ED: Social Science Designation; Integrative Learning Experience (Theme: "Sustainability and Global Resources")*

This course is designed to provide students with an understanding of the symbiotic relationship between technology and society. Examples of these relationships will be taken from historical accounts and from analyses of contemporary societies both in industrialized and non-industrialized countries. Lecture three hours.

#### **TEC 2043. Introductory Digital Electronics (3). On Demand.**

An introduction to number systems and codes, Boolean algebra and combinational logic circuits, integrated circuits and logic families, flip-flops, computing circuits, counters and registers. Topics included are switching function reduction and Karnaugh maps, integrated circuit specifications, circuit analysis, logic circuit and sequential machine design. Theory is reinforced by laboratory experiments where logic circuits, sequential machines, etc. are constructed and evaluated. Lecture two hours, laboratory two hours. Prerequisite: TEC 1023. (ND Prerequisite: passing the math placement test or successful completion of MAT 0010.)

#### **TEC 2108. Introduction to Power and Energy Technology (3). On Demand.**

An introduction to the study of sources, conversion, controlling, transmitting, and using power and energy. Emphasis will be placed on external, internal and electrical power and energy converters. Lecture two hours, laboratory two hours.

**TEC 2188. Transportation Systems and Devices (3).F.**

A study of the history and development of transportation systems and devices and the impact of transportation technologies on society. The student will explore the function, characteristics and structure of land, air, water and space transportation systems. Lecture two hours, laboratory two hours.

**TEC 2500. Independent Study (1–4).F;S.**

Approved contract is required.

**TEC 2601. Energy Issues and Technology (3).F;S.**

*GEN ED: Liberal Studies Experience*

This course will explore the various forms of energy and will examine the complete range of energy conversion systems existing in the world today. Students will examine energy resources, their economic and environmental impacts, and technologies used to exploit them. The course consists of three major sections: principles of power and energy, conventional energy resources, and renewable energy resources. Lecture three hours.

**TEC 2718. Building Mechanical Systems (3).F;S.**

This course introduces students to the design and installation of the mechanical systems in buildings - water supply and waste (plumbing); electrical; and heating, ventilation and air conditioning (HVAC). The course combines lectures on the theory, practice, drawing methods, and building codes related to these systems with hands-on procedures. Lecture two hours, laboratory two hours.

**TEC 2758. Surveying, Soils and Foundations (3).F;S.**

This course covers construction from initial site investigation through foundations. Key topics include: soils, soil testing, structural foundation design, surveying, site layout, site plans, and foundation construction. Lecture two hours, laboratory two hours. Prerequisite: MAT 1020.

**TEC 2803. Introduction to Industrial Applications of Computers (3). On Demand.**

An introduction to industrial applications of mainframe and microcomputers; to include BASIC programming, an overview of machine codes, input/output devices, and common industrial applications such as computer-aided drafting (CAD) and computer-aided manufacturing (CAM). Lecture two hours, laboratory two hours.

**TEC 3007. Fundamentals of Computer Numerical Control (3). On Demand.**

Underlying concepts, activities and processes used in Computer Numerical Control/Computer Aided Manufacturing. Students will use microcomputers, CAD, CNC, and CAM software to program and operate various machines used in manufacturing, as well as utilize computers for other operations necessary for a computer integrated manufacturing environment. Lecture two hours, laboratory two hours.

**TEC 3009. Introduction to the Technology Teaching Profession (3).F.**

An introduction to the career and technology education curriculum, as well as the professional roles and responsibilities of Technology Education and Trade and Industry teachers. Course expectations include lab activities related to career and/or technology education curriculum in North Carolina, interviews with master teachers, and field experiences in regional Career and Technical classrooms at the middle and high school levels. Prerequisite or co-requisite: TEC 2029. Prerequisite: RC 2001 or its equivalent.

**TEC 3013. Electronic Communications (3). On Demand.**

A study of modern electronic communications systems. Topics included are the representation of information by electronic signals, encoding, modulation, multiplexing, bandwidth and the transmission and reception of signals. Additionally, an introduction to communications media, modern networking, protocols, etc. is presented. Theory is reinforced by laboratory experiments. Lecture two hours, laboratory two hours. Prerequisite: TEC 1023.

**TEC 3035. Architectural Field Study (1-3).On Demand.**

Travel, tours, and study of areas of interest within the architecture profession. Metropolitan areas, historic building sites, design firms, and museums are typical destinations. Attendance and overnight stays are required. Graded on an S/U basis. Prerequisite: TEC 3728 or permission of the instructor.

**TEC 3036. Construction Management Field Study (1-3).On Demand.**

Travel, tours, and study of areas of interest within the construction industry. Conferences, large construction sites, and construction firms are typical destinations. Attendance and overnight stays are required. Graded on an S/U basis. Prerequisite: TEC 3728 or permission of the instructor.

**TEC 3037. Sustainable Building Systems Field Study (1-3).On Demand.**

Travel, tours, and study of areas of interest within the building performance industry. Conferences, buildings for field research, and building performance firms are typical destinations. Attendance and overnight stays are required. Graded on an S/U basis. Prerequisite: TEC 3728 or permission of the instructor.

**TEC 3038. Commercial Construction Technology (3).F;S.**

This course introduces students to the technical, economic and managerial aspects of the commercial and industrial construction industries. Primary emphasis is on the equipment, materials, and construction processes used in commercial construction. Lecture three hours. Prerequisites: MAT 1020, TEC 1708, and TEC 2758.

**TEC 3039. Materials Science (3).F;S.**

An in-depth study of the structure, characteristics, analysis, and application of modern engineering materials, with an emphasis on the processing/structure/properties/performance interrelationship. Topics include atomic structure and bonding, crystal structure and imperfections, solidification, mechanical properties, strengthening mechanisms, failure analysis, phase diagrams, heat treatment, corrosion and degradation, and materials characterization techniques. Lecture two hours, laboratory two hours.

**TEC 3053. Electronic Troubleshooting Techniques (3). On Demand.**

A study of the methods used to locate faulty components and other sources of equipment failure in modern electronic systems. Topics included are functional analysis, diagnostics, performance verification, and repair methods. Lecture two hours, laboratory two hours. Prerequisite: TEC 2043.

**TEC 3111. Portfolio Development (3).F;S.**

As students prepare for careers in a design field they should be aware of the importance of having a strong portfolio when looking for a job. The portfolio is one of the primary means of communication to show what one can do, and how one thinks or goes about solving a problem. This course will lead the students into the process of building their portfolios to a level that will allow them to be able to begin to compete for the jobs that are out there.

**TEC 3113. Administering Desktop Operating Systems (3). On Demand.**

This course provides students with experience in installation, configuration, troubleshooting, and administration of desktop operating systems. A wide variety of topics will be covered, including: installation techniques, storage management, hardware, security, and printers. Lecture two hours, laboratory two hours. Prerequisite: TEC 2803.

**TEC 3133. Server Based Operating Systems (3). On Demand.**

This course provides students with experience in installation, configuration, troubleshooting, and administration of server based operating systems. A wide variety of topics will be covered, including: storage management, network hardware, network protocols, and network printers. Lecture two hours, laboratory two hours.

**TEC 3153. Advanced Electronic Troubleshooting Techniques (3). On Demand.**

This course is a continuation of TEC 3053, Electronic Troubleshooting Techniques. A study of the methods used to locate faulty components and other sources of equipment failure in modern electronic systems. Topics included are functional analysis, diagnostic, performance verification, and repair methods. Lecture two hours, laboratory two hours. Prerequisite: TEC 3053.

**TEC 3500. Independent Study (1–4).F;S.**

Approved contract is required.

**TEC 3520. Instructional Assistance (1).F;S.**

A supervised experience in the instructional process on the university level through direct participation in a classroom situation. Graded on an S/U basis. Prerequisite: junior or senior standing. May be repeated for a total credit of three semester hours. Approved contract is required.

**TEC 3530–3549. Selected Topics (1–4). On Demand.**

**TEC 3604. Sustainable Transportation (3).F;S.**

This course will introduce students to emerging technologies and strategies for creating sustainable transportation systems. Specific topics may include: public transportation strategies, bicycle technologies, electric vehicles, energy efficient transportation options, and alternative fuels such as biodiesel, alcohol, natural gas, and hydrogen. The environmental, social, economic, and technological aspects of these options will be explored. Students will complete a significant independent project. Lecture three hours. Prerequisites: TEC 2601 and TEC 3638, or permission of the instructor.

**TEC 3605. Sustainable Resource Management (3).F.**

This course will introduce students to material efficiency strategies, recycling, composting, and the concept of life cycle design. A range of resource management philosophies, technologies and techniques will be discussed and analyzed. Students will complete a significant independent project. Lecture three hours. Prerequisite: TEC 2029 or permission of the instructor.

**TEC 3606. Sustainable Water and Wastewater Technology (3).S.**

This course will introduce students to both traditional and alternative water and wastewater treatment methods and technologies. Students will study how to analyze the water cycle and how to develop water management strategies which are both economically and environmentally sustainable. Topics may include water availability, water quality and purification techniques, water quality assessment, water pumping, efficiency, grey water, composting toilets, "living machines", and water policy. Students will complete a significant independent project. Lecture three hours. Prerequisite: TEC 2029 or permission of the instructor.

**TEC 3607. Electro/Mechanical Systems (3).On Demand.**

A study of mechanical systems and controls used in industry today. Basic mechanical, electrical, hydraulic, and pneumatic systems and their components will be included in the classroom activities. Lecture two hours, laboratory two hours.

**TEC 3638. Foundations of Sustainable Technology (3).F;S.**

*GEN ED: Junior Writing in the Discipline (WID)*

This course will explore through writing current topics in the sustainable technology field. Assignments will involve writing with feedback. Topics for writing assignments may include technical reports, white papers, system documentation, opinion pieces, summaries, literature reviews, experimental methods, and data analyses. The APA format will be stressed. Lecture three hours. Prerequisites: TEC 2029 and TEC 2601, or permission of the instructor, and RC 2001 or its equivalent.

**TEC 3718. Construction Estimating (3).F;S.**

This course provides students with the opportunity to explore and develop estimating skills used in the construction industry. Course material includes estimating unit costs of building components, quantity take-offs, and preparation of an overall project bid. Students prepare estimates using self-developed computer spreadsheets and are exposed to commercially available estimating software. Prerequisites: MAT 1020 or higher, TEC 1708, TEC 3038, and basic knowledge of computer word processing, Internet procedures, and spreadsheets. (ND Prerequisite: passing the math placement test or successful completion of MAT 0010.)

**TEC 3728. Architectural Design Studio I (3).F;S.**

This course will introduce students to the basic concepts of architectural design and some of the most important architects in recent history. The course will present the tools, processes, graphic conventions, and standards used in the design and construction of buildings. As a final project, students will design a building and prepare computerized construction drawings. Lecture two hours, studio two hours. Prerequisites: TEC 1708 and TEC 1728, or permission of the instructor.

**TEC 3738. Statics and Strength of Structures (3).F;S.**

This course utilizes a practical approach to introduce students to the principles and physical concepts of statics and strength of materials related to construction. Statics is the study of bodies and forces in equilibrium. The study of bridge types, trusses, and other structures will be integrated into the coursework in order to provide a practical framework for the subject matter. Lecture two hours, laboratory two hours. Prerequisites: MAT 1020, PHY 1103, TEC 1708, TEC 1728, TEC 2758, and TEC 3039.

**TEC 3748. Building Science (3).F;S.**

*GEN ED: Writing in the Discipline (WID)*

This course introduces students to the complex ways in which buildings interact with their environment. Topics may include indoor air quality, building durability, energy efficiency, and client comfort. Students will use building diagnostic equipment to test for house and duct leakage, indoor air quality, humidity, and air flow. The course also emphasizes interpreting and translating these findings into concise summaries as well as comprehensive written reports. Lecture two hours, laboratory two hours. Prerequisites: TEC 1708 and TEC 2718, MAT 1020 or higher, or permission of the instructor. (ND Prerequisite: passing the math placement test or successful completion of MAT 0010.)

**TEC 3758. Architectural Design Studio II (3).S.**

This is an advanced level course exploring the broad field of architectural building design. It investigates form, space, tectonics, and details of buildings. Students have the opportunity to learn a variety of design development techniques, including manual drafting, sketching and rendering, computer software, and physical model building. Required course projects include presentation drawings, construction drawings, renderings, and models. Lecture two hours, studio two hours. Prerequisite: TEC 3728.

**TEC 3803. Network Administration (3). On Demand.**

Students in this course will study basic strategies to manage, monitor, configure, and troubleshoot network services. Data security and integrity, and user management will be the main emphasis of the discussions. Lecture two hours, laboratory two hours. Prerequisite: TEC 3133.

**TEC 3807. Construction Safety (1).On Demand.**

A comprehensive coverage of occupational safety and health based upon OSHA standards. Students will be required to satisfactorily complete the OSHA 10 hour Construction course and must provide a certificate of completion. Graded on an S/U basis.

**TEC 3900. Industry Internship (1–3).** On Demand.

Field experience or employment in the area of the student's interest. Prerequisite: 16 hours of coursework in the major must be completed. Graded on an S/U basis. (Hours requirement for one credit hour is 160 hours, with 80 hours required for each additional credit.)

**TEC 4093. Senior Design and Fabrication Project (3).** On Demand.

A course in research and development of electronic systems. System design and integration will be emphasized. With the guidance of the instructor, students will identify a need, and develop an appropriate design. The design will be implemented and evaluated using modern components and subsystems. Lecture two hours, laboratory two hours. Prerequisite: TEC 3803.

**TEC 4103. Leadership in Technical Settings (3).** F;S.

This course provides an introduction to the nature of leadership in technical settings. Special emphasis is on behavior of individuals and groups in organizations. Students will begin to develop their own views of leadership based on theory, research, and experience. Lecture three hours.

**TEC 4407. Production Planning and Control (3).** On Demand.

An applied study of process planning and production control systems used in modern manufacturing. To include such topics as: production planning, automation, time and motion study, order control, flow control and quality control, and plant layout. Lecture two hours, laboratory two hours.

**TEC 4510. Senior Honors Thesis (1-3).** On Demand.

Independent study and research. Honors thesis directed by a member of the Department of Technology & Environmental Design. Co- or Prerequisites: completion of 6 semester hours of departmental honors work and permission of the departmental honors coordinator.

**TEC 4572. Production Management (3).** On Demand.

Practical management techniques and experience in the areas of sales, finance and high, middle, and lower level personnel management in an active printing production facility. This course will be taught concurrently with TEC 2012 Production Techniques in Graphic Arts. Lecture one hour, laboratory four hours. Prerequisite: TEC 2012.

**TEC 4573. Control System Technology (3).** On Demand.

A detailed study of the architecture of modern programmable control systems. The course will include computation, machine representation of information, storage structures, buses, input/output interfacing, peripheral devices, and instruction codes. Theory to be reinforced by hands on experience. Some theory and practical experience in Programmable Logic Controllers (PLC) will be introduced. Lecture two hours, laboratory two hours. [Dual-listed with TEC 5573.] Dual-listed courses require senior standing; juniors may enroll with permission of the department.

**TEC 4607. Wind and Hydro Power Technology (3).** F;S.

This course will introduce students to the basic concepts, tools, techniques and materials needed to design and construct systems that convert wind and hydro resources into electricity. Students will study how to measure these renewable resources and to estimate the power that could be produced from them. They will also have the opportunity to learn how to design and construct complete renewable electricity systems and become familiar with many contemporary products used in renewable electricity systems. The course will include classroom and "hands-on" design, construction and possibly some field trip experiences outside of class. Lecture two hours, laboratory two hours. Prerequisites: TEC 1708, TEC 1728, TEC 2029, TEC 2601, TEC 2718, and TEC 3638 or permission of the instructor. [Dual-listed with TEC 5607.] Dual-listed courses require senior standing.

**TEC 4608. Photovoltaic System Design and Construction (3).** F;S.

This course will introduce students to the basic concepts, tools, techniques and materials needed to design and construct systems that convert solar resources into electricity with photovoltaic (PV) technologies. Students will study how to assess the solar resources available at a particular site and how that information can be used to properly design PV systems. They will also have the opportunity to learn how to design and construct complete code compliant photovoltaic systems and become familiar with contemporary trends and products. The course will include classroom and "hands-on" design, construction and possibly some field trip experiences outside of class. Lecture two hours, laboratory two hours. Prerequisites: TEC 1708, TEC 1728, TEC 2029, TEC 2601, TEC 2718, and TEC 3638 or permission of the instructor. [Dual-listed with TEC 5608.] Dual-listed courses require senior standing.

**TEC 4618. Sustainable Building Design and Construction (3).** F;S.

This course introduces students to the concepts and best practices related to sustainable building design and construction. Course topics include green building certification programs, sustainable building design software, high performance construction practices, resource efficient material selection, sustainable site planning, water efficiency, indoor air quality, and passive solar design. The course also explores a variety of unconventional building techniques and building materials such as straw bale, adobe, cob, and geodesics. Other topics discussed include sustainable community design, low impact development, composting, recycling, and grey water systems. Prerequisites: TEC 1708 and TEC 2718 or permission of the instructor. [Dual-listed with TEC 5618.] Dual-listed courses require senior standing; juniors may enroll with permission of the department.

**TEC 4619. Curriculum Development in Career and Technology Education (3).SS.**

Planning and development of teacher- and student-directed activities that align with state curriculum models. Students will create instructional videos and a variety of computer-generated instructional materials for use in technology education and other career and technical education programs. Emphasis is also placed on assessment strategies and on locating, evaluating, and revising existing instructional materials including computer-based materials. Lecture three hours. [Dual-listed with TEC 5619.] Dual-listed courses require senior standing; juniors may enroll with permission of the department.

**TEC 4628. Solar Thermal Energy Technology (3).F;S.**

This course will introduce students to the basic concepts, tools, materials and techniques needed to convert solar energy into heat. Specific technologies to be studied include solar cookers, solar dryers, solar water heaters, solar water pasteurization/distillation, solar greenhouses/cold frames, and some house heating systems. Students should develop skills in the use of tools, materials, and processes which effectively and efficiently capture and convert the sun's energy into thermal energy. The course will include traditional classroom and "hands on" design, construction and testing activities. Lecture two hours, laboratory two hours. Prerequisites: TEC 1708, TEC 1728, TEC 2029, TEC 2601, TEC 2718, and TEC 3638 or permission of the instructor. [Dual-listed with TEC 5628.] Dual-listed courses require senior standing.

**TEC 4629. Organization and Management of Career and Technology Education (3).S.**

Instruction and laboratory experiences in the organization and management of technology education programs, including: selection and sources of equipment and supplies; facility planning; safety organization and management concerns; scheduling; student evaluation; and discipline. Computer applications incorporated throughout. Lecture three hours. [Dual-listed with TEC 5629.] Dual-listed courses require senior standing; juniors may enroll with permission of the department.

**TEC 4638. Contemporary Problems in Sustainable Technology (3).F;S.**

*GEN ED: Capstone Experience*

This course is designed to provide students with an overview of contemporary problems facing the Sustainable Technology movement such as affordable and efficient alternative energy systems, small scale production systems, waste management and recycling, bioregional development, community and shelter design and technology transfer methodology. Each student will have the opportunity to explore in-depth a problem of their choosing and will be given guidance in the identification, definition and analysis of their chosen problem. Both library research and prototype or model construction will be required. Lecture two hours, laboratory two hours. Prerequisite: TEC 4608 or permission of the instructor.

**TEC 4639. Career and Technical Student Organizations (3).S.**

An in-depth study of career and technical student organizations (CTSOs) and how to organize and manage a local chapter. Related activities such as service learning, establishing an advisory board, and career planning will also be covered. Lecture three hours. [Dual-listed with TEC 5639.] Dual-listed courses require senior standing; juniors may enroll with permission of the department.

**TEC 4649. Cooperative Vocational and Industrial Education (3).On Demand.**

Organization and administration of a cooperative program for vocational or interdisciplinary areas. Included are locating and maintaining training stations and developing training plans. Lecture three hours.

**TEC 4660. Instructional Strategies in Career and Technology Education (3).F.**

The study of instructional strategies appropriate for use in trade and industry (grades 9-12) and technology education (grades K-12) classrooms. Class discussions will focus on learning theory, design-based instruction, and standards-based instructional planning. Students will prepare lesson plans, prepare and deliver presentations and demonstrations, and engage in K-12 classroom-based observations. Lecture three hours. [Dual-listed with TEC 5660.] Dual-listed courses require senior standing; juniors may enroll with permission of the department.

**TEC 4667. Housing and Home Furnishings Seminar (1).On Demand.**

A seminar structured to prepare managers and leaders for careers in industry with emphasis on home furnishings, construction, and design. A highly interactive, open course with limited enrollment and guest speakers. Two-hour seminar, one day per week. The course includes an all day trip to the High Point furniture market. Graded on an S/U basis.



**TEC 4700. Biofuels Technology (3).F;S.**

An examination of evolving biofuel technologies such as biodiesel, alcohol, cellulose products, and methane which are being developed to displace depleting fossil fuels (diesel, gasoline, natural gas, and coal). This course will introduce students to the basic concepts, tools, techniques, and materials needed to assess, design, and construct biofuels technology systems. Coursework will include multimedia presentations, lectures, discussions, films, field trips, homework, guest-speakers, and laboratory activities. Topics include: internal combustion engine technology, biodiesel chemistry and physical properties, combined heat-power systems, materials compatibility, by-products, closed-loop designs, energy balance, life cycle assessment, ASTM specifications, fuel analysis, feedstocks, biofuels and agriculture, biofuels in developing countries, ethanol, cellulosic ethanol, biogas and landfill gas, and eco-industrial models. Lecture two hours, laboratory two hours. Prerequisite: TEC 3638, or permission of the instructor. [Dual-listed with TEC 5700.] Dual-listed courses require senior standing; juniors may enroll with permission of the department.

**TEC 4711. Computer Modeling of Renewable Energy Systems (3).F;S.**

This course will introduce students to a variety of software packages for modeling the performance of renewable energy systems, and will help them develop proficiency in their use. Software packages may include Excel, FChart, PVF Chart, BLCC, HOMER, Wind CAD, RETScreen, and ARC Reader. Students will study how to predict the performance of a variety of solar heating technologies, photovoltaics, wind turbines, and solar house designs. The economics and environmental benefits of renewable energy systems will also be explored. File formats and memory allocation schemes, as they relate to understanding data storage, will be discussed. Effective problem solving skills will be emphasized throughout the course. Lecture two hours, laboratory two hours. Prerequisite: TEC 3638 or permission of the instructor. [Dual-listed with TEC 5711.] Dual-listed courses require senior standing; juniors may enroll with permission of the department.

**TEC 4718. Construction Management (3).On Demand.**

This course introduces students to the mechanics of managing construction projects and personnel. Organizational structures, required licenses, codes, permits, safety requirements, personnel management, customer relations, scheduling, accounting, insurance, and financing are addressed. Special attention is given to the use of computer software, such as spreadsheets and scheduling programs, for construction management activities. Prerequisites: MAT 1020 or higher, TEC 1708, TEC 2718, TEC 3038, TEC 3718, and basic knowledge of computer word processing, Internet procedures, and spreadsheets. (ND Prerequisite: passing the math placement test or successful completion of MAT 0010.) [Dual-listed with TEC 5718.] Dual-listed courses require senior standing; juniors may enroll with permission of the department.

**TEC 4738. Architectural Design Studio III (4).F.**

This course builds on previous courses in construction technology and architectural design to demonstrate to the student how to integrate the myriad aspects of architecture - from art to environment to materials to spaces to construction - into successful building designs. The course stresses application of design fundamentals to building design, but emphasizes the key elements of buildability, efficiency, durability and indoor air quality. Lecture two hours, studio four hours. Prerequisites: TEC 3748 and TEC 3758.

**TEC 4748. Architectural Design Studio IV (4).S.**

This course serves as the capstone course for the major in Building Sciences with a concentration in Architectural Technology and Design. The course proceeds through the entire architectural design process during the semester, culminating in the design of a structurally sound, efficient, durable, high performance building that meets all relevant building codes. Lecture two hours, studio four hours. Prerequisites: TEC 3038, TEC 3718, TEC 3738, and TEC 4738.

**TEC 4758. Planning and Scheduling (3).F;S.**

This course introduces students to the complex process of planning for construction projects. The course covers project planning and scheduling, determining and leveling project resources, estimating, budgeting, and cost control for construction projects. Special attention will be given to the use of specialized scheduling software for construction management activities. Prerequisites: MAT 1020 or higher, TEC 1708, TEC 2718, TEC 3038, and TEC 3718. [Dual-listed with TEC 5758.] Dual-listed courses require senior standing; juniors may enroll with permission of the department.

**TEC 4768. Construction Administration (3).F;S.**

This course is an in-depth study of the administrative aspects of construction projects. Topics covered include organizational structures, required licenses, taxes, codes, permits, safety requirements, personnel management, customer relations, value engineering, insurance, accounting, and financing. Prerequisites: MAT 1020 or higher, TEC 1708, TEC 2718, TEC 3038, and TEC 3718.

**TEC 4778. Integration of Building Design and Construction Management (3).F;S.**

This is an advanced level course exploring the broad field of how architectural building design, engineering, and construction management interface with one another. It investigates Integrated Project Delivery methods using Computer-aided Drafting and Design (CADD), Building Information Modeling (BIM) and physical model building. Required course projects include a full set of construction drawings, cost estimates, project planning, and scheduling. Lecture two hours, laboratory two hours. Prerequisites: TEC 3718, TEC 3728, TEC 3738. Co-requisite: TEC 4758.



**TEC 4788. Integration of Energy and Building Systems (3).F;S.**

This course is an advanced study of the physical principles behind the interaction of both residential and commercial buildings with the environment, including the performance of heating, cooling, ventilation, and humidity control systems. Traditional, high performance, and emerging technologies and practices are studied in the context of energy efficiency. Load calculations, system specification, and system integration are explored using the latest building information modeling (BIM) software tools. Lecture two hours, laboratory two hours. Prerequisites: TEC 3718, TEC 3728, TEC 3748, TEC 4618.

**TEC 4900. Internship (3–12).F;S.**

*GEN ED: Capstone Experience;* Graded on an S/U basis.

**TEC 4910. Practicum in the Career and Technology Education Classroom (1).F;S.**

Prospective technology education teachers are introduced to technology education classrooms and school communities through field experiences in secondary schools. Observation, participation, and teaching experiences ranging from individual to large group settings are included. Reflection, analysis, and discussions of practicum experiences are integrated into regularly scheduled seminars. Students will complete inquiry projects and participate in interdisciplinary teaming while developing rapport with technology education students and examining the context of effective technology education learning environments. This course provides experiential learning through both field experiences and weekly lectures. Prerequisite or co-requisite: TEC 4660. Graded on an S/U basis