Engineering Technology

Web Site: http://www.odu.edu/engtech

Ike Flory, Interim Chair

Old Dominion University has a unique advantage of having both engineering technology and engineering programs. The Engineering Technology Department offers baccalaureate programs in Civil, Electrical and Mechanical Engineering Technology with opportunities for specialization in multiple areas.

The primary goal of the Department of Engineering Technology and its programs is to provide a general yet sufficiently specialized education to equip the student for immediate employment in a variety of engineering and technical fields. In general, the engineering technology programs provide an opportunity for students who desire a technical undergraduate education to apply engineering knowledge to solve actual industrial problems. As a result, the engineering technology programs emphasize the practical application of technical knowledge with a strong laboratory program supporting the lecture content of the curricula. For further information, please visit the department web site: http://www.odu.edu/engtech.

Mission Statement

The mission of the Engineering Technology Department is to provide students with preeminent, nationally recognized engineering technology programs that carefully balance theory, robust applied laboratory and engaging classroom experiences designed to serve as a strong foundation of knowledge and skills, enabling graduates to seize opportunities in traditional and emerging careers in civil, electrical and mechanical engineering technology.

The Department of Engineering Technology offers programs in civil engineering technology (CET), electrical engineering technology (EET), and mechanical engineering technology (MET) that lead to the Bachelor of Science in Engineering Technology degree. These programs are accredited by the Engineering Technology Accreditation Commission of ABET, http://www.abet.org. Graduates of these programs are eligible to take the Fundamentals of Engineering (FE) or the Fundamentals of Land Surveying (FLS) examination in Virginia and in most states. The exam is the first step to licensure as a professional engineer. The CET, EET, and MET programs also offer different concentrations and areas of specialization to meet student interests and industry needs. These concentrations and areas of specialization are listed under each program.

All upper-level courses required for all engineering technology programs are delivered via distance learning through ODU's distance learning system. Thus, students with associate degrees may complete degree requirements without attending the main campus.

A program in general engineering technology is available through the interdisciplinary studies degree program in the College of Arts and Letters. For more information, please see the Arts and Letters section of this catalog.

Computer Requirement

The Frank Batten College of Engineering and Technology requires that all incoming freshmen to the college have a notebook or laptop computer that meets or exceeds the Mobile Monarch Student Notebook Program's recommended models for engineering majors. Students are strongly encouraged to consider purchasing one of the Mobile Monarch Student Notebook Program's notebooks; however, students may bring their own notebook if it meets the specifications. More information, including the notebook loaner program, can be found at https://www.odu.edu/efd.

Civil Engineering Technology

Nestor Escobales, Program Director

The Civil Engineering Technology (CET) program is accredited by the Engineering Technology Accreditation Commission of ABET, http://www.abet.org/. The CET program offers areas of specialization in construction management, structural design, and site development. Students in this program are prepared for employment in a wide range of professional and technical positions with the construction, consulting engineering, surveying and site development industries. Graduates are eligible to take the Fundamentals of Engineering exam, the first step to licensure as a professional engineer. CET courses include topics such as computer-aided drafting, statics, strength of materials, materials testing, surveying, building construction, steel and concrete design, soils and foundations, and hydrology and drainage. Effective written, oral and graphic communications are practiced throughout the curriculum along with computer literacy. The program culminates in a senior project that integrates course work with a practical project assignment in the student's area of interest. To satisfy the upper-division general education requirements, students are encouraged to complete a minor in engineering management, business management, environmental health and safety, or mechanical engineering technology.

Construction Management Area of Concentration

This option prepares students for careers in the construction industry by providing a combination of knowledge and skills from a number of disciplines. In addition to the basic technical skills in structures, fluids, hydraulics, etc., students in construction management take courses in scheduling, project management, cost estimating, and other topics that enable projects to be completed on schedule and within budget. Graduates of the construction management area of concentration are employed at both large and small companies as project engineers, field engineers, assistant superintendents, estimators, schedulers, and similar construction related positions.

Structural Design Area of Concentration

This option prepares students for careers in the construction industry by providing a combination of knowledge and skills from a number of disciplines. In addition to the basic technical skills in structures, fluids, etc., students in structural design take courses in computer applications in structural design, structural steel, reinforced concrete, wood design, design of structural systems, and environmental loads. Graduates from this concentration have found employment at both large and small companies as design engineers, project engineers, structural engineers, and similar structural related positions.

Site Development Area of Concentration

This option prepares students to develop survey plans, prepare subdivision plats, design site improvements, obtain and approve subdivisions, and provide turn-key services to manage developments. Students choosing this area of concentration will take course work in hydrology and drainage, land design and development, boundary law, and hydraulic engineering. Graduates from this concentration are employed in government agencies, engineering firms and surveying firms.

Civil Engineering Technology Program

Mission Statement

The mission of the Civil Engineering Technology (CET) program is to sustain a high quality undergraduate program of study leading to the Bachelor of Science in Engineering Technology degree. The program prepares graduates to become certified in their area of specialization. Civil engineering technology is a significant component of the University's commitment to science, engineering and technology, particularly in structural design, construction, site development and related fields, which are of major importance to civilization. Students around the world are enabled to expand opportunities to enhance their education and pursue baccalaureate level studies through the University's distance learning program. Simultaneously, the program supports the general education components that yield a well-rounded graduate who is aware of and able to address societal needs and issues.

Program Objectives

The objective of the Civil Engineering Technology program is to prepare graduates to establish themselves as successful professionals in structural building design, construction, and surveying/land design or related areas during the first few years of their careers by having demonstrated their ability to:
1. Address and solve increasingly complex technical problems related to one's professional field and area of specialization.
2. Make well educated, responsible and ethical decisions that will have a positive impact on organization and society.
3. Work effectively in teams and precisely communicate ideas.
4. Continue personal and professional growth.

Typical technical problems that CET graduates will be able to address include: building and non-building type structures and construction operations. Typical technical tasks the CET graduates will be expected to perform include: planning and design, field testing and inspection, on-site technical coordination and control, and other tasks relevant to one's emphasis area.

**Program Outcomes**

The civil engineering technology program has adopted, after deliberations by its constituents, 11 outcomes for the Bachelor of Science program in civil engineering technology. These outcomes are listed below.

1. an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities;
2. an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies;
3. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes;
4. an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives;
5. an ability to function effectively as a member or leader on a technical team;
6. an ability to identify, analyze, and solve broadly-defined engineering technology problems;
7. an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature;
8. an understanding of the need for and an ability to engage in self-directed continuing professional development;
9. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity;
10. a knowledge of the impact of engineering technology solutions in a societal and global context; and
11. a commitment to quality, timeliness, and continuous improvement.

**Accreditation**

The Bachelor of Science in Engineering Technology - Civil Engineering Technology is accredited by the Engineering Technology Accreditation Commission of ABET www.abet.org. (http://www.abet.org)

**Civil Engineering Technology Curriculum**

Critical CET course sequences within the Civil Engineering Technology curricula require a minimum grade of C before progressing to subsequent courses. Refer to the individual CET course descriptions for information on specific C grade prerequisites. A grade of C- does not satisfy the requirement for a C grade.

### Freshman

#### First Term
- CET 120: 3 Hours
- ENGN 110: 2 Hours
- MATH 162M: 3 Hours
- CHEM 121N: 3 Hours

#### Second Term
- Human Creativity Way of Knowing: 3 Hours
- ENGT 111: 2 Hours
- MATH 163: 3 Hours
- PHYS 111N: 4 Hours

Total credit hours: 126

1. Does not include the University's General Education language and culture requirement. Additional hours may be required.
2. Meets the philosophy and ethics general education requirement.
One or more additional courses will be required to complete a minor. See advisor for details.

Students with an interest in construction, design or site development may substitute an alternate course with approval of their advisor.

Declaring a concentration is not mandatory. However, if a concentration is declared, at least three courses must be taken from that concentration area. The remaining two courses can be taken from any of the other available concentrations.

Meets the impact of technology general education requirement.

The General Education requirements in information literacy and research and philosophy and ethics are met through the major.

Electrical Engineering Technology
Otilia Popescu, Program Director
The electrical engineering technology (EET) program is accredited by the Engineering Technology Accreditation Commission of ABET, http://www.abet.org/. The EET program offers computer engineering technology, communications systems technology, embedded systems technology, mechatronics systems technology and power systems technology concentration areas. Students in all concentrations take courses in dc and ac circuits, electronic devices and circuits, digital electronics, linear electronics, microprocessors, and programming. Supporting laboratories provide experience in instrumentation, testing and trouble-shooting, and design and implementation. Graduates should be qualified for application positions in electronic and electrical product design and development, electronic and electrical system operation and maintenance, field operations, and various other technical functions.

Computer Engineering Technology Concentration
Students choosing the computer engineering technology (ComET) concentration will take a series of courses offered by both the Department of Engineering Technology and the Department of Computer Science. These include additional C++ programming and problem solving, data structures, and software engineering. The remainder of the program will consist of a combination of senior electives in computer science and specific electrical courses that support the computer engineering technology concentration. Computer engineering technology program students will automatically satisfy a minor in computer science.

Communications Systems Technology Concentration
Students choosing the communications systems technology concentration (CMCT) will receive technical instruction in fundamental electrical engineering technology with a focus upon communication systems through upper-division required communication courses. Students have the choice of two senior elective courses that can add to the communication systems concentration area or in other related areas of electrical engineering technology. To satisfy the upper-division general education requirement students are also required to complete any minor in the College of Engineering and Technology or the College of Sciences.

Mechatronics Systems Technology Concentration
Students choosing the mechatronics systems technology concentration (MCHT) will receive technical instruction in fundamental electrical engineering technology with a focus upon mechatronics systems through upper-division EET required courses in microcontrollers/microprocessors, PLCs, power and communication systems. Students will also take mechatronics-related courses in the mechanical engineering technology program. Students completing the requirements of the mechatronics systems technology concentration will automatically satisfy a minor in mechanical engineering technology.

Power Systems Technology Concentration
Students choosing the power systems technology concentration (PWRT) will receive technical instruction in fundamental electrical engineering technology with a focus upon electrical power systems through upper-division required electrical power-based courses. Students have the choice of two senior elective courses that can add to the power systems concentration area or in other related areas of electrical engineering technology. To satisfy the upper-division general education requirement, students are required to complete any minor in the College of Engineering and Technology or the College of Sciences.

Electrical Engineering Technology Program
Mission Statement
The mission of the Electrical Engineering Technology (EET) program is to sustain a high quality undergraduate program of study leading to the Bachelor of Science in Engineering Technology degree. It is a significant component of the University’s commitment to science, engineering and technology, particularly in fields of major importance to the region. Through the University’s distance learning program, the electrical engineering technology program provides opportunities for technical personnel throughout the state and elsewhere to enhance their education and pursue baccalaureate level studies. Simultaneously, the program supports the general education components that yield a well-rounded graduate who is aware of societal needs and issues.

Program Objectives
The objective of the electrical engineering technology program is to prepare graduates to establish themselves as successful professionals in electrical and computer engineering technology or related areas during the first few years of their careers by having demonstrated their ability to:

1. Address and solve increasingly complex technical problems related to one's professional field and area of specialization.
2. Make well educated, responsible and ethical decisions that will have a positive impact on organization and society.
3. Work effectively in teams and precisely communicate ideas.
4. Continue personal and professional growth.

Typical technical problems that EET graduates will be able to address include: planning, specification, development, design, procurement of equipment and materials, implementation, and performance verification. Typical technical tasks the EET graduates will be expected to perform include: conduct engineering experiments, make observations, collect and analyze data, and formulate conclusions.

Program Outcomes
The electrical engineering technology program has adopted, after deliberations by its constituents, 11 outcomes for the Bachelor of Science program in electrical engineering technology. These outcomes are listed below.

1. an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities;
2. an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies;
3. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes;
4. an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives;
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7. an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature;
8. an understanding of the need for and an ability to engage in self-directed continuing professional development;
9. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity;
10. a knowledge of the impact of engineering technology solutions in a societal and global context; and
11. a commitment to quality, timeliness, and continuous improvement.

Accreditation
The Bachelor of Science in Engineering Technology - Electrical Engineering Technology is accredited by the Engineering Technology Accreditation Commission of ABET www.abet.org.

Electrical Engineering Technology Curriculum
Critical EET course sequences within the Electrical Engineering Technology curricula require a minimum grade of C before progressing to subsequent courses. Refer to the individual EET course descriptions for information on specific C grade prerequisites. A grade of C does not satisfy the requirement for a C grade.

Computer Engineering Technology Concentration*

Freshman

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Sophomore

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Senior

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Total credit hours: 128

* Does not include the University's General Education language and culture requirement. Additional hours may be required.
1 CHEM 121N and CHEM 122N are recommended, especially for those who plan to take the Fundamentals of Engineering Examination.
2 Meets philosophy and ethics general education requirement.
3 The ComET concentration will automatically satisfy a minor in Computer Science

The General Education requirements in information literacy and research, impact of technology, and philosophy and ethics are met through the major.

Communications Systems Technology Concentration*

Freshman

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Sophomore

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Engineering Technology 4
### Sophomore

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### Junior

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### Senior

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Total credit hours: 127

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* Does not include the University's General Education language and culture requirement. Additional hours may be required.

1 CHEM 121N and CHEM 122N are recommended, especially for those who plan to take the Fundamentals of Engineering Examination.

2 Meets philosophy and ethics general education requirement.

3 Students must select from any minor in either the College of Engineering and Technology or the College of Sciences. Note that minors requiring more than four courses will increase the total credits required to complete the degree.

The General Education requirements in information literacy and research, impact of technology, and philosophy and ethics are met through the major.
Does not include the University’s General Education language and culture requirement. Additional hours may be required.

CHEM 121N and CHEM 122N are recommended, especially for those who plan to take the Fundamentals of Engineering Examination.

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**Mechatronics Systems Technology Concentration***

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students are required to complete a minor within the College of Engineering. Examples of such minors include computer-aided drafting, statics, strength of materials, dynamics, marine systems. Students in this program take common courses in areas such as computer-aided drafting, statics, strength of materials, dynamics, and marine systems. The General Education requirements in information literacy and research, language and culture requirement. Additional hours may be required.

Mechanical Engineering Technology

The mechanical engineering technology (MET) program is accredited by the Engineering Technology Accreditation Commission of ABET, http://www.abet.org/. The MET program offers areas of concentration in manufacturing systems, mechanical systems design, nuclear systems, and marine systems. Students in this program take common courses in areas such as computer-aided drafting, statics, strength of materials, dynamics, thermodynamics, fluid mechanics, automation and controls, and computer solid modeling. The program culminates in a senior project that integrates course work with a practical project assignment in the student's area of interest. To satisfy the upper-division general education requirements, students are required to complete a minor within the College of Engineering and Technology or the College of Sciences. Graduates should be qualified for application positions in mechanical product design, development and manufacturing, mechanical system operation and maintenance, field operations, and various other technical functions.

Manufacturing Systems Area of Concentration

Along with the courses previously mentioned, various senior electives are available in the manufacturing area such as robotics, computer numerical control in production, advanced manufacturing processes, and lean engineering. Graduates of the manufacturing systems area of concentration are prepared for employment in a wide range of professional and technical positions at both large and small companies in areas such as manufacturing engineering, quality control, production management, test engineering, and maintenance management.

Mechanical Systems Design Area of Concentration

The mechanical systems design area of concentration provides the skills for career success in designing, building, and installing mechanical systems of all descriptions including thermal and air conditioning systems, automated production equipment, and power systems. Graduates of this area of concentration are prepared for careers in engineering, fabrication, and technical positions in both the public and private sectors.

Nuclear Systems Area of Concentration

The nuclear systems area of concentration is a special program available only to graduates of the U. S. Navy Nuclear Power School or programs related to nuclear power plant operation through Dominion Energy. These students receive advanced standing credits that apply to the MET degree based on their professional education in nuclear power systems.

Marine Systems Area of Concentration

Senior electives related to this area of concentration include: MET 474 Naval Architecture I, MET 475 Principles of Marine Engineering I, MET 476 Principles of Marine Engineering II, and MET 485 Maintenance Engineering. It should attract students interested in ships' systems operation and the shipbuilding/repair industry.

Mechatronics Systems Area of Concentration

The mechatronics systems area of concentration provides the skills for career success in design and implementation of electro-mechanical systems used commonly in factories today. Senior electives related to this area of concentration include: MET 426 Introduction to Mechatronics, MET 427 Mechatronics System Design.

Mechanical Engineering Technology Program

Mission Statement

The mission of the Mechanical Engineering Technology (MET) program is to sustain a high quality undergraduate program of study leading to the Bachelor of Science in Engineering Technology degree. It is a significant component of the University's commitment to science, engineering and technology, particularly in fields of major importance to the region. Through the University's distance learning program, the mechanical engineering technology program provides opportunities for technical personnel throughout the state and elsewhere to enhance their education and pursue baccalaureate level studies. Simultaneously, the program supports the general education components that yield a well-rounded graduate who is aware of societal needs and issues.

Program Objectives

The objective of the mechanical engineering technology program is to prepare graduates to establish themselves as successful professionals in mechanical systems or related areas during the first few years of their careers by having demonstrated their ability to:

1. Address and solve increasingly complex technical problems related to one's professional field and area of concentration.
2. Make well educated, responsible and ethical decisions that will have a positive impact on organization and society.

The General Education requirements in information literacy and research, impact of technology, and philosophy and ethics are met through the major in information literacy and research, language and culture requirement. Additional hours may be required.

Mechanical Engineering Technology

Nathan Luetke, Program Director

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Program Objectives

The objective of the mechanical engineering technology program is to prepare graduates to establish themselves as successful professionals in mechanical systems or related areas during the first few years of their careers by having demonstrated their ability to:

1. Address and solve increasingly complex technical problems related to one's professional field and area of concentration.
2. Make well educated, responsible and ethical decisions that will have a positive impact on organization and society.
3. Work effectively in teams and precisely communicate ideas.
4. Continue personal and professional growth.

Typical technical problems that MET graduates will be able to address include: planning, specification, development, design, procurement of equipment and materials, implementation, and performance verification. Typical technical tasks the MET graduates will be expected to perform include: conduct engineering experiments, make observations, collect and analyze data, and formulate conclusions.

Program Outcomes
The mechanical engineering technology program has adopted, after deliberations by its constituents, 11 outcomes for the Bachelor of Science program in mechanical engineering technology. These outcomes are listed below:

1. an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities;
2. an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies;
3. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes;
4. an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives;
5. an ability to function effectively as a member or leader on a technical team;
6. an ability to identify, analyze, and solve broadly-defined engineering technology problems;
7. an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature;
8. an understanding of the need for and an ability to engage in self-directed continuing professional development;
9. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity;
10. a knowledge of the impact of engineering technology solutions in a societal and global context; and
11. a commitment to quality, timeliness, and continuous improvement.

Accreditation
The Bachelor of Science in Engineering Technology - Mechanical Engineering Technology is accredited by the Engineering Technology Accreditation Commission of ABET www.abet.org. (http://www.abet.org)

Mechanical Engineering Technology Curriculum*
Critical MET course sequences within the Mechanical Engineering Technology curricula require a minimum grade of C before progressing to subsequent courses. Refer to the individual MET course descriptions for information on specific C grade prerequisites. A grade of C- does not satisfy the requirement for a C grade.

Freshman

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<td>Human Creativity Way of Knowing</td>
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Gen Ed Literature 3

Total credit hours: 127

* Does not include the University's General Education language and culture requirement. Additional hours may be required.

** Must be taken together.

*** Meets philosophy and ethics general education requirement.

**** Students must select from any minor in either the College of Engineering and Technology or the College of Sciences. Note that minors requiring more than four courses will increase the total credits required to complete the degree.

General Education requirements in information literacy and research, impact of technology, and philosophy and ethics are met through the major.

Engineering Technology 8
CIVIL ENGINEERING TECHNOLOGY Courses

CET 120. Civil 2D Computerized Aided Drafting. 3 Credits.
This course is computer based drafting, where methods are taught with a major emphasis on practical application using two-dimensional AutoCAD software in the computer lab. This includes the basic principles of Civil Engineer drawings to include but not limited to: dimensioning and tolerances, spot elevations, contours, plan and profile view, section views, details, scaling, measurements. It will introduce students to site plan drawings, mechanical view, structural views, architectural views, roadway plan and profiles, as well as buried infrastructure plan and profiles. Finally, it will be the basis for preparation of a working set of plans, for use in all follow-on CET courses.

CET 200. Statics. 3 Credits.
Scalar methods and free body diagrams are employed in the analysis of discrete and distributed force systems and their application to bodies in external equilibrium. Friction, moment of inertia, and center of gravity are also included. Pre- or corequisite: MATH 211.

CET 205. Principles of Surveying. 3 Credits.
Basic plane surveying measurements and computations, survey control systems, elementary digital mapping and simple curves, and building construction survey and stakeout. Field exercises using standard surveying instrumentation, traverse and leveling techniques, topographic mapping and curve layout. Prerequisites: MATH 163 and MET 120 or CET 120.

CET 210. Fundamentals of Building Construction. 3 Credits.
Introduction to various materials and methods available for design and construction of buildings. Covers application and combination of traditional materials and methods, and recent innovations in construction systems.

CET 220. Strength of Materials. 3 Credits.
Mechanical behavior of materials subjected to various external loads. Stress-strain relationships are utilized to design members subjected to shear, axial, bending, and torsional loads. Deformations are predicted and Mohr's circle is introduced. Prerequisites: MATH 211 and CET 200.

CET 260. Plan and Specifications. 3 Credits.
A detailed study of the form and content of typical plans and specification documents used in the construction industry. The use of computer-aided drafting (CAD) in assembling a set of plans and specifications. Prerequisite: CET 210 or CET 120 or MET 120.

CET 295. Topics. 1-3 Credits.
Study of selected topics.

CET 296. Topics. 1-3 Credits.
Study of selected topics.

CET 301. Structural Analysis. 3 Credits.
Determination of forces, moments, and deflections in statically determinate and indeterminate beams, frames, and trusses due to various load cases and load combinations. Methods of analysis will include matrix stiffness analysis, moment distribution and other approximate and computer methods. Prerequisites: CET 220 and MATH 211.

CET 325. Introduction to Land Development. 3 Credits.
Applications of fundamental site engineering principles, land design principles and permitting issues. A brief historical review of exemplary subdivision, urban designs and their impact on current practice. Site surveying and engineering issues including hydrology, storm water management, site geometry, grading, design of roads, engineering design standards, and computer applications in site engineering are examined. The principles of siting and theories of design for aesthetic and efficient alignment of roads, layout of structures, and subdivision parcels are introduced. Prerequisite: CET 210.

CET 330. Fluid Mechanics. 3 Credits.
Elementary mechanics of fluids. Fluid properties; hydrostatics; fluid kinematics; equations of motion; energy equation; momentum principles; flow of liquids and gasses in closed conduits; flow in open channels and/or compressible flow. Use of spreadsheets is required. Prerequisites: CET 220 and MATH 211.

CET 332. Water Resources Engineering. 3 Credits.
Hydrologic and Hydraulic principles are utilized in the planning, design, operation and construction of water management projects. The course addresses fundamental Hydrology - the occurrence and movement of surface water including weather and climate; precipitation; evaporation; transpiration; runoff; infiltration; stream flow; hydrograph analysis; erosion; and sedimentation. Additional topics covered will include water distribution, use of water, and sustainability of water as a natural resource. Prerequisites: CET 330.

CET 334. Computer Applications in Hydraulic Engineering. 3 Credits.
Application of computer software in solving water resources problems; program development or application of available packages to solve assigned water resources problems. Use and application of commercial software for analysis and design of water distribution networks and gravity sewer collection systems. Prerequisite: CET 330.

CET 340. Soils and Foundations. 3 Credits.
A study of the engineering properties of soil including stress, shear strength, and bearing capacity. Movement of water through soils, consolidation and settlement of structures and the design of shallow and deep foundations are also covered. Use of Excel spreadsheets is a requirement. Prerequisites: CET 330.

CET 341W. Soils Testing Laboratory. 2 Credits.
Course includes standard methods for inspecting, sampling, testing, and evaluating soils. Students use typical test equipment and perform tests on samples of local soils. A written report is required for each experiment. This is a writing intensive course. Prerequisites: a grade of C or better in ENGL 211 C or ENGL 221 C or ENGL 231 C. Pre- or corequisite: CET 340.

CET 345W. Materials Testing Laboratory. 2 Credits.
Standard methods of inspecting and testing structural materials used in construction are followed. A written report is required for each experiment. This is a writing intensive course. Prerequisites: grade of C or better in ENGL 211 C or ENGL 221 C or ENGL 231 C. Pre- or corequisite: CET 220.

CET 355. Sustainable Building Practices. 3 Credits.
The course will examine industry trends in sustainable building practices. It explores the green building strategies used in the design and construction of sustainable buildings. The role of site selection, water efficiency, energy, materials and resources, and indoor environmental quality will be explored. Prerequisites: Junior standing.

CET 365. Building Information Modeling (BIM). 3 Credits.
This course is an introduction to building information modeling (BIM) and its implementation in building design and construction. Topics include the fundamentals of information modeling; business benefits of BIM; impacts of BIM on design and construction processes; integrated design process and project delivery; popular software applications and basic modeling techniques; and popular areas and best practices of BIM implementation. Prerequisite: CET 260.

CET 367. Cooperative Education. 1-3 Credits.
Available for pass/fail grading only. Student participation for credit based on the academic relevance of the work experience, criteria, and evaluative procedures as formally determined by the department and Career Management prior to the semester in which the work experience is to take place. (offered fall, spring, summer) (qualifies as a CAP experience) Prerequisites: Approval by the CET program director and Career Development Services (CDS) in accordance with the policy for granting credit for Cooperative Education programs; a student who needs to add additional credit to maintain full-time status should contact the program director.

CET 368. Internship. 1-3 Credits.
Available for pass/fail grading only. Academic requirements will be established by the department and will vary with the amount of credit desired. Allows students to gain short duration career-related experience. Prerequisites: approval by department and Career Development Services.

CET 369. Practicum. 1-3 Credits.
Available for pass/fail grading only. Prerequisites: approval by department and Career Development Services.
CET 395. Topics. 1-3 Credits.
Topics in Civil Engineering Technology. Prerequisites: permission of the instructor.

CET 396. Topics. 1-3 Credits.
Topics in Civil Engineering Technology. Prerequisites: permission of the instructor.

CET 400. Computer Applications in Structural Design. 3 Credits.
Use and application of commercial software for analysis and design of building and non-building type structures. Determination of compliance with strength, serviceability, and fabrication requirements. Introduction to computer modeling in 2D and 3D, pre and post processors, interpretation of results and development of professionally written reports. Pre- or corequisite: CET 301.

CET 405. Environmental Loads. 3 Credits.
Familiarize the student with the analysis of environmental design loads required for the design of building and non-building type structures in the United States. A thorough study of loading categories and load combinations for ASD and LRFD is also covered. Extensive use of the International Building Code (IBC) and the Minimum Design Loads for Building and Other Structures (ASCE 7) is expected. Prerequisites: CET 220.

CET 408. Hydraulic Engineering. 3 Credits.
Analysis of hydraulics problems associated with the design of civil engineering structures. Uniform, steady flow in open channels; hydraulic models; design problems for dams; spillways and hydraulic structures; hydraulic machinery and other related topics will be discussed. Use of spreadsheets is required. Prerequisites: CET 330.

CET 410. Reinforced Concrete Design. 3 Credits.
Structural analysis and design of reinforced concrete members. Topics include flexural analysis and design of structures, including slabs, beams and columns using strength design procedures. Pre- or corequisite: CET 301.

CET 415. Design of Structural Systems. 3 Credits.
This course focuses on assembly design as opposed to member design as learned in structural design courses. The students are able to work on the overall stability of structures using one or more building materials such as concrete, wood, steel, cold-formed steel, and/or masonry. The use of building codes, standards and specifications is required. The main objective of this class is to adequately prepare the student for the senior design project. The course also offers an introduction to low-rise building design. Prerequisites: CET 450 or CET 410 or CET 452.

CET 420. Hydrology and Drainage. 3 Credits.
Hydrologic and hydraulic principles are utilized in the planning, design, operation and construction of water management projects. Topics include elements of stormwater drainage pertaining to hydrology, hydraulics of open channel and pipe flow, stormwater management, and issues pertinent to state stormwater regulations and the Chesapeake Bay Preservation Act. Prerequisites: CET 330.

CET 428. Buried Infrastructure. 3 Credits.
This is a capstone design course in the field of water resources. It incorporates pressurized pipe flow, gravity flow, and hydrology into the design of municipal infrastructure for water, sewer and stormwater projects. Topics will also cover rehabilitation and replacement of aging infrastructure in urban and neighborhood settings. Use of spreadsheets is required. Prerequisites: CET 332 or CET 334 or CET 325.

CET 435. Design of Reinforced Concrete Foundations. 3 Credits.
Analysis and design of reinforced concrete foundations typically used in buildings and bridges. Topics include loads and loading groups, methods of analysis and design, abutments, and isolated and continuous footings. The class will be focused on the load and resistant factor design method. Use of the ASCE 7, ACI and AASHTO codes is necessary. Prerequisites: CET 340 and CET 410.

CET 440. Contract Documents. 3 Credits.
The basic concepts of contracts and the standard contract documents used in construction. Also included is a study of the dispute resolution process in arbitration. Prerequisites: CET 210.

CET 445. Construction Planning and Scheduling. 3 Credits.
The basic elements of planning and scheduling building construction projects. All elements of building construction, including the precedence methods of scheduling. Use of computers and planning and scheduling software are emphasized. Prerequisites: CET 210.

CET 450. Structural Steel Design. 3 Credits.
Structural analysis and design of steel structures, including beams, girders, columns, composite sections, trusses, rigid frames and connections using the LRFD method. Analysis of statically-determinate cantilever (hungspan) systems also are covered. Pre- or corequisite: CET 301.

CET 452. Wood Design. 3 Credits.
Analysis and design of wooden structural elements of buildings to satisfy code designs. Included are shearwall design and connections as well as beams, columns and other elements. Pre- or corequisite: CET 301.

CET 460. Construction Cost Estimating. 3 Credits.
Evaluation and analysis of the basic elements of estimating construction costs for buildings. Elements of take off and pricing for Division 1 through Division 6 are covered. Use of computers and estimating software are emphasized. Prerequisites: CET 210.

CET 465. Construction Project Management. 3 Credits.
An introduction to the procedures and methods that are used by a contractor during the construction phase of a project. Special emphasis on planning, managing and documenting project activities. Topics include job site layout and control, subcontracting and purchasing and changes and claims/progress payments. Prerequisite: CET 210.

CET 468. Construction Finance. 3 Credits.
A study of financial management in construction for civil engineering projects based on conceptual and construction plans. The emphasis of the course is on building construction but equally applicable to other construction type projects. Development of techniques required to effectively monitor the financial aspects of construction projects. This course is practice oriented. Use of spreadsheets is highly recommended. Prerequisite: Junior Standing.

CET 470. Infrastructure, Heavy Highway and Equipment. 3 Credits.
Methods and resources used to construct traditional civil infrastructure systems. Equipment utilization. Prerequisites: CET 205 and CET 210.

CET 485. Bridge Design. 3 Credits.
Familiarize the student with the analysis and design of simple and continuous span bridge structures utilizing the Load and Resistance Factor Design (LRFD) methodology. Determination of the most common design loads used in bridge design. Introduction to the AASHTO Specification for Structural Bridge Design used in United States. Prerequisite: CET 410 or CET 450.

CET 495. Topics. 1-3 Credits.
Topics in civil engineering technology. Prerequisite: permission of the instructor.

CET 496. Topics. 1-3 Credits.
Topics in civil engineering technology. Prerequisites: permission of the instructor.

ELECTRICAL ENGINEERING TECHNOLOGY Courses

EET 110. Electrical Circuits I. 3 Credits.
Fundamentals of electrical circuits including basic electrical parameters and variables, circuit laws and theorems, mesh analysis, node analysis, Thevenin's and Norton's Theorems, capacitance, inductance, magnetism, and element RC and RL transients. Prerequisite: MATH 162M.

EET 120. Logic Circuits and Microprocessors. 3 Credits.
An introduction to logic circuits, Boolean algebra, digital interface devices, combinational and sequential logic design, and microprocessor fundamentals. (Offered Fall.)

EET 125. Logic and Microprocessor Laboratory. 1 Credit.
Team-oriented experiments in basic combinational and sequential logic circuits and an introduction to fundamental microprocessors. (offered fall) Pre- or corequisite: EET 120.
EET 195. Topics. 1-3 Credits.
Study of selected topics.

EET 200. Electrical Circuits II. 3 Credits.
A continuation of EET 110 with emphasis on steady-state ac circuit analysis and applications. Topics include alternating current and voltage, phasors and complex numbers and their applications in circuit analysis, series and parallel resonance, complex power, and polyphase circuits. Prerequisites: MATH 163 and a grade of C or better in EET 110. (offered fall).

EET 205. Circuits Laboratory. 1 Credit.
Electrical laboratory instruction including test equipment, measurements, data analysis, verification of circuit laws, formal report preparation, and circuit construction. Pre- or corequisite: EET 200.

EET 210. Electronic Devices and Circuits I. 3 Credits.
Semiconductor properties and semiconductor devices including diodes, MOS field-effect transistors, junction field-effect transistors and bipolar junction transistors. The ideal operational amplifier and its applications. FET and BJT biasing, including constant current biasing, and amplifier circuits with emphasis on dc modeling and graphical analysis. Multisim simulation of circuit biasing. Prerequisites: EET 110.

EET 220. Electronic Devices and Circuits II. 3 Credits.
A continuation of EET 210. Small-signal analysis of transistor circuits emphasizing the hybrid-equivalent circuit. Analysis of high frequency effects in FETs and BJTs and their effect on frequency response. Waveform generating and waveform modification circuits. High power devices and their applications, including power supplies and power amplifiers. Multisim simulation of circuit gain and frequency response. Prerequisites: EET 200 and EET 210.

EET 225. Electronics Laboratory. 1 Credit.
Practical design, construction, testing and troubleshooting of electronic circuits including single state and multistage amplifiers, power amplifiers, linear integrated circuits, and control devices. Prerequisite: EET 205. Pre- or corequisite: EET 220.

EET 261. Introduction to Microprocessors and Microcontrollers. 3 Credits.
Introduction of software and hardware that relates to PIC16FXXX 8 bit microprocessor and microcontroller architectures, interface circuitry, and system designs. Programming in controls of internal and external hardware/ peripherals, communication protocols between the logic circuits, peripherals, and MCUs. The ASM programming and design is the focus and C coding will also be introduced. Pre- or corequisite: EET 120.

EET 295. Topics. 1-3 Credits.
Study of selected topics.

EET 300. Advanced Circuit Analysis. 3 Credits.
General analysis of linear networks using classical methods, Laplace transforms and computer-aided methods. Topics include single element transients, first- and second-order circuits, transfer function analysis, and phasor analysis. Bode plots and waveform analysis. Circuit analysis software is used to support the analytical methods. Prerequisites: MATH 211 and a grade of C or better in EET 200.

EET 305. Advanced Technical Analysis. 3 Credits.
Analytical and computational methods to support upper-division engineering technology courses. Topics include linear algebra, ordinary differential equations of engineering systems, elements of vector analysis, introductory statistical concepts, and software usage/development. MATLAB is used throughout the course to support all the topics. Prerequisites: a grade of C or better in MATH 211.

EET 310. Digital Electronics. 3 Credits.
First course in an upper division sequence in digital electronics circuits and systems. Topics include a comprehensive treatment of Boolean algebra, computer arithmetic, and applications of digital integrated circuits. Prerequisites: EET 120, EET 125, EET 205, and EET 210.

EET 312. Wireless Communications I. 4 Credits.
Overview of communications systems including both time and frequency domain analysis. Topics include spectrum analysis, analog modulation methods, digital modulation methods, receiver design, and cellular technology. Virtual laboratory projects utilizing simulation software. Prerequisites: EET 300 and EET 305.

EET 315. Digital Electronics Laboratory. 2 Credits.
Application oriented experiments and design problems in digital electronics. Prototype construction using wire-wrap methods will also be covered. Formal written reports will be required. Pre- or corequisite: EET 310.

EET 320. Advanced Microprocessors and Microcontrollers. 3 Credits.
This is the second course in the digital electronics course sequence. The course will focus on software/hardware design of microprocessors and microcontrollers in C under ARM M4 and PIC microcontrollers, interface circuitry, simulation, and system designs in CAD circuit layout. The focus will be on application of microprocessor-based systems design. Prerequisites: EET 261 and EET 310.

EET 325. Microprocessor Laboratory. 2 Credits.
Hands-on implementation of microprocessor and microcontroller systems and peripheral interfacing experiments. Emphasis is placed on the hardware and software design and firmware construction in embedded system applications. Pre- or corequisite: EET 320.

EET 330. Linear Electronics. 3 Credits.
General treatment of linear electronic circuits with emphasis on the operational amplifier and integrated circuits derived from it. Topics include various amplifier circuits and converters, integrators and differentiators, comparators, waveform generators, active filters, A/D and D/A converters, and regulators. Design of circuits to meet specifications. Circuit analysis software is used to validate some of the designs. Prerequisites: EET 220 and EET 300.

EET 335. Linear Electronics Laboratory. 2 Credits.
Design testing, and evaluation of "linear" electronic circuits and subsystems with primary emphasis on circuit components and modules. Measurement techniques, instrumentation and error analysis. Simulation of circuit designs using Multisim including transient response and frequency response. Pre- or corequisite: EET 330.

EET 340. Transmission Networks. 3 Credits.
Transmission line theory including both transients and steady-state conditions. Smith chart and its application to RF design. Introduction to electric and magnetic fields and plane wave propagation. Circuit analysis software is used to support the analytical methods. Prerequisite: EET 300.

EET 350. Fundamentals of Electrical Technology. 3 Credits.
A comprehensive course in electrical engineering technology for nonmajors. Major topics are basic electricity (AC and DC), circuit analysis, linear electronics and digital electronics. Not open to electrical engineering technology majors except as a substitute for EET 110 in special cases. Pre- or corequisite: MATH 211.

EET 355. Electrical Laboratory. 1 Credit.
Selected electrical laboratory topics for nonmajors including basic measurements, instrumentation, operational amplifiers, digital circuits, and rotating machines. Not open to electrical engineering technology majors. Pre- or corequisite: EET 350.

EET 360. Electrical Power and Machinery. 3 Credits.
A study of synchronous and asynchronous AC machinery, DC machinery, power distribution systems, and instrumentation. Prerequisite: EET 200 or EET 350.

EET 363. Introduction to PLC. 3 Credits.
Application oriented experiments and design problems in programmable controller setup and programming techniques with emphasis on practical applications. Networking PLCs and HMs. Computer assignments include ladder programs simulation. Students taking this course should not take EET 415. Prerequisite: EET 310 or EET 350.
EET 365W. Electrical Power and Machinery Laboratory. 2 Credits.
A laboratory course dealing with electrical power and machinery as covered in EET 360. Formal written reports will be required. This is a writing intensive course. Prerequisites: A grade of C or better in ENGL 211C or ENGL 221C or ENGL 231C; EET 205 or EET 355. Pre- or corequisite: EET 360.

EET 366. Electrical Power and Machinery Laboratory. 1 Credit.
A laboratory course dealing with electrical power and machinery as covered in EET 360. Students taking this lab should not take EET 365W. Prerequisite: EET 205 or EET 355. Pre- or corequisite: EET 360.

EET 367. Cooperative Education. 1-3 Credits.
Available for pass/fail grading only. Student participation for credit based on the academic relevance of the work experience, criteria, and evaluative procedures as formally determined by the department and Career Development Services prior to the semester in which the work experience is to take place. Prerequisites: approval by the department and Career Development Services in accordance with the policy for granting credit for Cooperative Education programs.

EET 368. Internship. 1-3 Credits.
Available for pass/fail grading only. Academic requirements will be established by the department and will vary with the amount of credit desired. Allows students to gain short duration career-related experience. Prerequisites: approval by department and Career Development Services.

EET 369. Practicum. 1-3 Credits.
Available for pass/fail grading only. Prerequisites: approval by department and Career Development Services.

EET 370T. Energy and the Environment. 3 Credits.
A study of existing and new energy production methods, energy as a purchased/traded commodity, physics of energy, positive and negative implications for the environment, economics of energy alternatives, and resulting human/social impacts. Prerequisite: PHYS 101N or PHYS 111N or PHYS 226N or PHYS 231N.

EET 373. Instrumentation. 3 Credits.
Fundamental concepts of electro-mechanical devices used in mechatronics and automation control systems. The working principles, calibration, interfacing methods and control loops of analog and digital instrumentation devices in a process control system. The instrumentation devices, including sensors, actuators, signal conditioning circuits and data acquisition boards, will be used in class projects as basic feedback control blocks in practical simulation and PLC based mechatronics systems. The simulation projects will use PLC hardware, MATLAB and/or LabView software. Prerequisites: EET 210 and EET 363.

EET 395. Topics. 1-3 Credits.
Study of selected topics. Prerequisite: junior standing.

EET 396. Topics. 1-3 Credits.
Study of selected topics. Prerequisite: junior standing.

EET 400. CAD Electronics. 3 Credits.
An upper-division study of the fundamentals of electronic schematic capture, circuit simulation, and printed circuit board design using microcomputers. Schematic symbols, simulation models, and pcb modules are developed by the students. Prerequisites: EET 310, EET 320, and EET 325.

EET 405. Introduction to Local Area Networks. 3 Credits.
Design, installation, and management of PC based local area networks. Topics include network topology (Ethernet, token ring, FDDI, etc.), network interface card installation and configuration, client/server hardware, LAN/WAN concepts, bridges and routers, and software controls. Prerequisites: EET 320 and EET 325.

EET 410. Communication Principles. 3 Credits.
Fourier series and transforms, spectral analysis, signal transmission, analog modulation and detection methods, sampling theorem, pulse and digital modulation methods, and time-division and frequency-division multiplexing. Prerequisite: EET 300 or EET 350.

EET 412. Wireless Communications II. 3 Credits.
A continuation of EET 312. Topics include digital encoding techniques, signal-to-noise comparisons of different analog and digital modulation methods, link analysis, and satellite communication. System level simulations for determining subsystem design requirements and overall performance. Prerequisites: EET 312.

EET 415. Programmable Machine Controls. 3 Credits.
Application oriented experiments and design problems in programmable controller setup and programming techniques with emphasis on practical applications. Computer assignments include ladder programs simulation. Students taking this course should not take EET 363. Prerequisite: EET 310 or EET 350.

EET 420. Advanced Logic Design. 3 Credits.
Advanced digital logic design and circuit reduction. Topics include lattice structure, symmetry recognition and simplification, threshold logic, design-for-testing techniques, shortest path test planning, adaptive testing, and fuzzy logic. Computer assignments include design simulation and testing. Prerequisite: EET 310.

EET 430. Automatic Control Systems. 3 Credits.
A study of modern control devices and applications including electrical, mechanical and pneumatic types. Prerequisites: EET 305, EET 330, EET 360, and EET 365W.

EET 440. High Frequency and Microwave Technology. 3 Credits.
Methods for generating, transmitting, and detecting signals in the VHF, UHF, and microwave frequency ranges. Laboratory will emphasize high frequency and microwave measurements including bridges, slotted lines, spectrum analyzers and reflectometers. Prerequisite: EET 340.

EET 450. Digital Control Systems. 3 Credits.
A study of modern digital control systems including the sampling process of linear systems, modeling of discrete systems, z-transforms, analysis of discrete systems, signal conversion, the digital computer as controller, feedback and cascade compensation, and hardware and software for digital control systems. Prerequisites: EET 305, EET 320, EET 325, and EET 330.

EET 460. Modern Communication Systems. 3 Credits.
Overview of the principles of satellite communications, television systems, fiber optics, antennas and other relevant topics. Prerequisite: EET 410.

EET 470. Microcontrollers/Embedded-Based Designs. 3 Credits.
Advanced embedded system designs. Topics focus in ADC, DAC, EEPROM External Memories, temperature sensor, digital RF wireless communications, communications in synchronous and asynchronous serial forms of SCI, SPI, & I2C, and parallel communication in system integration and design. The 32 bit ARM M4 in C code designs will be used in the course. Prerequisites: EET 310, EET 320, and EET 325.

EET 485. Electrical Power Systems. 3 Credits.
Fundamentals of electrical power transmission and distribution systems. Transformer operation/application, balanced/unbalanced loads, power factor correction, per-unit system system applications, fault calculations, power quality, over-current protection, relay construction/application, lighting system design, grounding, and introduction to the National Electric Code. Prerequisite: EET 360.

EET 490. Computer-Aided Circuit Simulation. 3 Credits.
Advanced treatment of computer-aided analysis software such as Multisim and MATLAB and the applications to electronic circuit analysis and design. Topics include non-linear models, distortion analysis, spectral analysis, and Monte Carlo techniques. Prerequisites: EET 300, EET 330, EET 335, and EET 340.

EET 495. Topics in Electrical Engineering Technology. 1-3 Credits.
Study of selected topics. Prerequisite: junior standing.

EET 496. Topics in Electrical Engineering Technology. 1-3 Credits.
Study of selected topics. Prerequisite: junior standing.
ENGINEERING TECHNOLOGY Courses

ENGT 111. Engineering Technology Information Literacy/Research. 2 Credits.
Fundamental information literacy and research as applied to engineering technology. Course includes where and how to efficiently locate and critically evaluate technical information. Proper use of technical information and the associated ethical and legal issues will be examined. Prerequisite: ENGN 110.

ENGT 434. Introduction to Senior Project. 1 Credit.
This course must be taken in the semester prior to the Senior Project course. A collection of career-related topics pertaining to engineering technology. Topics include engineering codes and standards, engineering ethics, technical report writing, job search and resume writing techniques, patents and property rights, and professional engineering licensure. The course concludes with the selection of the student's project topic for the subsequent Senior Project course. Prerequisite: Senior standing.

ENGT 435W. Senior Design Project. 3 Credits.
A capstone course utilizing upper-level coursework involving independent or group design projects under the direction of a sponsoring faculty member. Projects may involve analytical and/or experimental results. Formal written and oral reports will be required. This is a writing intensive course. Prerequisites: ENGT 434; senior standing or faculty approval; grade of C or better in ENGL 211C or ENGL 221C or ENGL 231C.

MECHANICAL ENGINEERING TECHNOLOGY Courses

MET 120. Computer Aided Drafting. 3 Credits.
Computer based drafting methods are taught with a major emphasis on 'Hands On' practice using 2-D AutoCAD software in the computer lab, along with the various methods of editing, manipulation, visualization and presentation of technical drawings. This course includes the basic principles of engineering drawing/hand sketching, dimensioning and tolerancing.

MET 200. Manufacturing Processes and Methods. 3 Credits.
Application and characteristics, both physical and chemical, of the materials most commonly used in industry as well as procedures and processes used in converting raw materials into a finished product.

MET 225. Material Science Laboratory. 1 Credit.
A laboratory course dealing with the standard methods of inspecting and testing materials used in engineering applications with emphasis on laboratory reports, including presentation and interpretation of experimental data.

MET 240. Computer Solid Modeling. 3 Credits.
A treatment of modern 3-D parametric solid modeling techniques including introduction of the software utilized sketching, parts and assembly creation techniques, orthographic views extraction and manufacturing drawing generation. Presentations include exploded views and animation. Prerequisites: MET 120.

MET 295. Topics. 1-3 Credits.
Study of selected topics.

MET 300. Thermodynamics. 3 Credits.
The basic laws of thermodynamics, properties of fluids, heat, and work and their applications in processes and cycles and an introduction to conduction heat transfer. Prerequisites: CHEM 121N, MATH 211, and PHYS 111N or PHYS 231N.

MET 305. Fundamentals of Mechanics. 3 Credits.
Selected topics in statics and strength of materials are applied to mechanical engineering technology. Coverage includes force systems, equilibrium, friction, and stress-strain relationships and their application to the mechanical behavior of materials. Prerequisites: PHYS 111N and MATH 211.

MET 310. Dynamics. 3 Credits.
A fundamental treatment of coplanar and three-dimensional kinematics and kinetics of particles and rigid bodies, including relative motion, mass moments of inertia, Newton's laws, work and energy, impulse and momentum, and simple vibrations. Prerequisites: MATH 211, CET 200, and PHYS 111N or PHYS 231N.

MET 320. Design of Machine Elements. 3 Credits.
A rapid review of the fundamental principles of strength of materials and working stresses followed by practical analyses of fundamental machine elements such as shafts, springs, and screws. Prerequisites: MATH 211, a grade of C or better in CET 220 and PHYS 111N or PHYS 231N.

MET 330. Fluid Mechanics. 3 Credits.
The study of fluid statics and dynamics, including momentum, energy, Bernoulli's equation, laminar and turbulent fluid flow and friction in pipes, fluid machinery, and open-channel flow. Prerequisites: MET 310.

MET 335W. Fluid Mechanics Laboratory. 1 Credit.
A laboratory course dealing with the verification of fluid equations and principles and the characteristics of fluid machinery with emphasis on laboratory report writing, including presentation and interpretation of experimental data. This is a writing intensive course. Prerequisite: A grade of C or better in ENGL 211C or ENGL 221C or ENGL 231C. Pre- or corequisite: MET 330.

MET 350. Thermal Applications. 3 Credits.
A study of basic applications of thermodynamics. Topics include the basic steam and gas turbine power plant, introduction to refrigeration systems, psychometrics, basic conduction and convection heat transfer including heat exchangers and surveys of other energy conversion systems. Prerequisites: MET 300.

MET 367. Cooperative Education. 1-3 Credits.
May be repeated for credit. Available for pass/fail grading only. Student participation for credit based on the academic relevance of the work experience, criteria, and evaluative procedures as formally determined by the department and the Career Development Services program prior to the semester in which the work experience is to take place. (offered fall, spring, summer) Prerequisites: approval by the department and Career Development Services in accordance with the policy for granting credit for Cooperative Education programs.

MET 368. Internship. 1-3 Credits.
Available for pass/fail grading only. Academic requirements will be established by the department and will vary with the amount of credit desired. Allows students to gain short duration career-related experience. Prerequisites: approval by department and Career Development Services.

MET 369. Practicum. 1-3 Credits.
Available for pass/fail grading only. Prerequisites: approval by department and Career Development Services.

MET 370. Automation and Controls. 3 Credits.
A study of the design and analysis of feedback control system. Includes the fundamentals of programmable controllers as well as practical applications of interfacing mechanical, electrical, pneumatic and hydraulic feedback control circuits. Computer simulation software is used to model system responses. Pre- or corequisite: EET 350. Prerequisite: MATH 211.

MET 386. Automation and Controls Laboratory. 1 Credit.
Laboratory and computer simulation of control systems including programmable controllers as well as practical applications of interfacing mechanical, electrical and pneumatic control systems. Pre- or corequisite: MET 370.

MET 387. Power and Energy Laboratory. 2 Credits.
Experiments dealing with applied thermodynamics, mechanical power and energy systems with emphasis on laboratory report writing, including presentation and interpretation of experimental data. Prerequisites: MET 335W and MET 350.

MET 395. Topics. 1-3 Credits.
Study of selected topics. Prerequisite: permission of the instructor.

MET 396. Topics. 1-3 Credits.
Study of selected topics. Prerequisite: permission of the instructor.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MET 400</td>
<td>Computer Numerical Control in Production</td>
<td>3</td>
<td>Principles of computer numerical control consistent with most recently developed standards, industry practices, and CAD/CAM systems including such topics as types of CNC machines, CNC milling, CNC turning and CNC electro-discharge machinery. A significant portion of the course includes programming in multiple axes. Prerequisites: Senior standing.</td>
</tr>
<tr>
<td>MET 410</td>
<td>Advanced Manufacturing Processes</td>
<td>3</td>
<td>A course in nontraditional manufacturing processes including ultrasonic machining, abrasive jet machining, waterjet cutting, electromechanical machining, electrical discharge machining, plasma arc machining and chemical milling. Semester project is required. (qualifies as a CAP experience) Prerequisites: MET 200.</td>
</tr>
<tr>
<td>MET 415</td>
<td>Introduction to Robotics</td>
<td>3</td>
<td>An introductory course in robotics dealing with the history and development of robots, mechanical components and control systems, actuators, robot programming and utilization. Included are laboratory experiments in robot motion and programming. Prerequisites: MET 310 and EET 350.</td>
</tr>
<tr>
<td>MET 420</td>
<td>Design for Manufacturing</td>
<td>3</td>
<td>Principles of design for manufacturing, materials and process selection for design, design for assembly, design for production and case studies. Also includes impact of product design, design for maintenance, recyclability, disassembly, quality and robustness. Semester project requires redesign of an existing product for manufacturing. Prerequisite: MET 200.</td>
</tr>
<tr>
<td>MET 426</td>
<td>Introduction to Mechatronics</td>
<td>3</td>
<td>A study of the mechatronics concepts and their application on actual problems encountered in engineering practice. Includes the basics of electromechanical systems, electrical circuits, solid-state devices, digital circuits and motors, all of which are fundamental to understanding mechatronic systems. Prerequisites: EET 355 or MAE 225.</td>
</tr>
<tr>
<td>MET 427</td>
<td>Mechatronic System Design</td>
<td>3</td>
<td>A study of the integrated modeling and optimal design of a physical system, which includes sensors, actuators, electronic components, and its embedded digital control system. Includes simultaneous optimal design practice with respect to the realization of the design specifications related to different engineering domains. Prerequisites: EET 355 or MAE 225.</td>
</tr>
<tr>
<td>MET 430</td>
<td>Mechanical Subsystem Design</td>
<td>3</td>
<td>Fundamental principles required for the correct design of the separate elements which compose the machine with attention given to problems of synthesis and the interrelationships of the design of elements within the sub-assembly. Topics include stress analysis of screws, belts, clutches, brakes, chains and thin and thick cylinders, and lubrication and bearings. Prerequisites: MET 320.</td>
</tr>
<tr>
<td>MET 431</td>
<td>Modeling and Simulation of Mechatronic Systems</td>
<td>3</td>
<td>The course provides foundations, principles, methods, and tools for modeling and simulation of electro-mechanical components and systems using appropriate modeling techniques. The course is focused on the multi-body dynamics systems, fluid, hydraulic, and electrical systems. Prerequisite: Senior standing.</td>
</tr>
<tr>
<td>MET 440</td>
<td>Heat Transfer</td>
<td>3</td>
<td>A study of conduction, convection and radiation heat transfer and heat exchangers. Emphasis is on applications and problem solving using current techniques, and modern correlations. Prerequisite: MET 300.</td>
</tr>
<tr>
<td>MET 445</td>
<td>Computer Integrated Manufacturing</td>
<td>3</td>
<td>Principles of computer integrated manufacturing, system integration, architecture and data base development. Topics include part design specifications, process engineering, fixed automation and process planning. Prerequisites: senior standing.</td>
</tr>
<tr>
<td>MET 450</td>
<td>Energy Systems</td>
<td>3</td>
<td>A study of the application of thermodynamics to power plants, engines, compressors, turbines, and associated systems. A detailed study is made of fossil fuel power plants with an introductory study of nuclear power and other energy conversion systems. Prerequisites: MET 350.</td>
</tr>
<tr>
<td>MET 455</td>
<td>Lean Engineering</td>
<td>3</td>
<td>This course looks at the history of lean and six sigma philosophies, their principles and implementation methodologies for creating a world class enterprise. Topics in Lean include five s, value stream mapping, cellular manufacturing, pull system, performance metrics, Lean supplier network, Lean product development and Lean implementation models. Semester research report is a course requirement. Class activities may involve physical simulation of production environment. Prerequisites: Senior standing.</td>
</tr>
<tr>
<td>MET 460</td>
<td>Refrigeration and Air Conditioning</td>
<td>3</td>
<td>The design and application of refrigeration and air conditioning systems. Studies are made of compressors, condensers, evaporators, psychrometric processes, load calculations and air distribution systems. High performance vapor compression systems, absorption systems and other cycles are analyzed. Prerequisites: MET 330 and MET 350.</td>
</tr>
<tr>
<td>MET 465</td>
<td>Geometric Dimensioning and Tolerancing</td>
<td>3</td>
<td>Methods and rules of dimensioning and tolerancing, calculation of fits, and geometrical tolerances using ANSI-Y14.5M, tolerances of form, orientation, and profile, including flatness, straightness, circularity, cylindricity, angularity, etc. Student work consists of designing and detailing various product drawings. Prerequisites: Senior Standing.</td>
</tr>
<tr>
<td>MET 471</td>
<td>Nuclear Systems I</td>
<td>3</td>
<td>Reactor physics principles as applied to the design and operation of various types of commercial nuclear power reactors. Topics include sources of radiation and interaction with matter, neutron interactions, diffusion theory, and reactor kinetics. Prerequisites: MATH 211 and PHYS 111N.</td>
</tr>
<tr>
<td>MET 472</td>
<td>Nuclear Systems II</td>
<td>3</td>
<td>Complete study of the nuclear fuel cycle, from mining through fabrication, fuel management in an operating commercial power reactor, spent fuel management, and fuel reprocessing, with emphasis on chemical engineering considerations. Prerequisites: MET 471, CHEM 121N and CHEM 122N or equivalent.</td>
</tr>
<tr>
<td>MET 474</td>
<td>Naval Architecture I</td>
<td>3</td>
<td>This course includes fundamentals of ship and marine vessel design, including ship geometry, hydrostatics, intact and damage stability, marine structures, resistance and propulsion, and shipbuilding and construction of marine vessels. Students will learn how these topics apply to naval and commercial ships, sailing vessels, and recreational small craft. Prerequisites: MAE 220 or CET 220, MAE 303 or CEE 330 and MET 330.</td>
</tr>
<tr>
<td>MET 475</td>
<td>Marine Engineering I</td>
<td>3</td>
<td>This course includes: fundamental principles of naval architecture including nomenclature, geometry, stability, hydrostics, structures, and motions; ship design processes; and a basic introduction to shipboard systems such as HVAC, refrigeration, power generation, propulsion, hydraulics, electronics, cargo handling systems, seawater systems, freshwater systems, and fuel, lube and other oil systems. Prerequisites: MET 330 and MET 350.</td>
</tr>
<tr>
<td>MET 476</td>
<td>Marine Engineering II</td>
<td>3</td>
<td>This course builds upon MET 475 and provides a more in-depth look on how the marine shipbuilding industry is using various software including SIEMENS PLM, 3D CAD modeling and new technologies like laser scanners and augmented reality to reshape the future of shipbuilding, maintenance, and repair processes. Focus will be based on model-based learning and creating a “digital thread” of information. Students will practice what they learn on shipbuilding concepts using commercial software that is widely used across automotive, aerospace, and marine industries. Prerequisites: MET 475.</td>
</tr>
<tr>
<td>MET 480</td>
<td>High Performance Piston Engines</td>
<td>3</td>
<td>A study of the fundamental principles and performance characteristics of spark ignition and diesel internal combustion engines. Overview of engine types and their operation, engine design and operating parameters; ideal and semi-empirical models of engine cycles; combustion, fluid flow and thermal considerations in engine design and performance. Laboratory evaluation of engine performance using flow and dynamometer systems. (cross-listed with MAE 477/MAE 577) Prerequisite: MET 350 or MAE 312.</td>
</tr>
</tbody>
</table>
MET 485. Maintenance Engineering. 3 Credits.
This course looks at maintenance systems: predictive, preventative and corrective; large scale maintenance systems, principles of reliability engineering, maritime logistics; planning for maintenance and repair, using and ordering spare parts, technical manuals, system specifications, and shipyard operations. Prerequisites: EET 305 and MET 200.

MET 490. Lean Enterprise. 3 Credits.
The history of lean philosophy, founding principles, and the extension of these principles to above-shop-floor activities to create a lean enterprise. Topics include five s, value stream mapping, cellular manufacturing, pull system, performance metrics, point of use storage, built-in-quality, mistake proofing and lean implementation models. Research report on one of the lean principles is a course requirement. Prerequisites: MET 200.

MET 495. Topics in Mechanical Engineering Technology. 1-3 Credits.
Study of selected topics. Prerequisite: permission of the instructor.

MET 496. Topics in Mechanical Engineering Technology. 1-3 Credits.
Study of selected topics. Prerequisite: permission of the instructor.