Energy Systems Technology and Education Center

Faculty
Executive Director
vacant

Chair/Instructor
Pitcher

Coordinators/Instructors
Fort
Perschon
E. Smith
Tauscher
V. Williams

Advanced Instructors
S. Larson
Maclure
Shepherd

Instructors
Brooks
S. Ellis

One Basic Technical Certificate, two Intermediate Technical Certificates, and six Associate of Applied Science degrees are available.

In response to a growing need for Engineering Technicians in the energy sector, the College of Technology at Idaho State University has established the Energy Systems Technology and Education Center (ESTEC) on the Idaho State University campus in Pocatello, Idaho.

ESTEC offers a unique approach to educating students by providing the specific knowledge and skills needed in energy production. The skills requirements have been developed in partnership with energy utilities and vendors to assure that program graduates enter the workforce with the precise skills required by the energy industry in a broad spectrum of electrical, oil, gas, renewable, and allied manufacturing sectors. Students learn through traditional classroom experience as well as through extensive laboratory exercises. Electrical generation technologies addressed include nuclear, coal, gas, and renewable technologies.

ESTEC was formed as a public/private partnership between Idaho State University, Idaho National Laboratory, and Partners for Prosperity. Curriculum and laboratory resources were developed with external funding from the US Department of Labor and the National Science Foundation.

Objectives
The Educational Objectives of the Energy Systems Engineering Technology programs at ISU reflect the application of curricular content. Graduates of the programs in the Energy Systems Technology & Education Center (ESTEC) at Idaho State University are able to:

1. Practice the Energy Systems Engineering Technology discipline successfully within community-accepted standards.
2. Provide leadership for and communicate effectively in a team-based environment in order to be agents of change in dynamically changing organizations.
3. Analyze and design optimized solutions to systems of people, technology and information.
4. Practice teamwork and communications skills to develop a successful career.
5. Fulfill professional and ethical responsibilities in the practice in energy systems engineering, including social, environmental and economical considerations.
6. Engage in professional service, such as participation in professional society and community service.
7. Engage in life-long learning activities, such as graduate studies or professional workshops.
8. Develop a professional career in the prevailing market that meets personal goals, objectives and desires.

Students interested in an Energy Systems program should understand that a criminal record may affect employability in the energy industry.

Graduates will have hands-on experience setting up and troubleshooting a variety of energy and manufacturing components and systems through knowledge of various types of electrical power generation methods and an understanding of industry health and safety practices.

Students must meet minimum admissions criteria to qualify for entry into an Energy Systems Engineering Technology program. See specific program requirements at http://www2.isu.edu/estec/. Acceptance into ESTEC programs is based upon available openings and other competitive criteria defined on the application.

Entry into the Energy Systems Instrumentation Engineering Technology, Energy Systems Electrical Engineering Technology, and Industrial Controls Associate degree programs requires completion of: ESET 0100, ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, and ESET 0142; the first two years of the Electrical Apprenticeship AAS degree program; or instructor approval. Program degrees will be awarded concurrently with completion of the Electrical Apprenticeship degree requirements.

Students are required to earn a grade of C- (1.7) or better in each ESET and INST prefixed course and a cumulative 2.0 GPA in ESET and INST courses to advance each semester and count toward an ESTEC degree or certificate. If the student fails to successfully complete any math, theory, or lab course, then that course must be repeated and a passing grade obtained before the student can advance in the program. The student must exit the program and make up the deficiency through advisor-approved methods. The student will then be allowed to repeat the course at the next available program opening. Specific information is available in the program’s student handbook.

The courses listed in each program will be taught in sequential blocks of instruction. Students must register concurrently for the lab course associated with each theory course. For a Program Information Packet, visit http://www.isu.edu/ctech/programs.shtml, which leads to descriptions of each program in general, course descriptions, lists of course sequences, and the cost of books, tools, uniforms, fees, and other expenses.

For all Energy Systems Engineering Technology programs, a student who has successfully completed ESET 0141 and ESET 0142, Applied Mathematics I and II, may enroll directly into an academic math course which requires MATH 1147 as a prerequisite.
Official articulation agreements have been established with other post-secondary and secondary schools. Where these agreements exist, the specific block of training (i.e., session/semester/year) will be accepted as equivalent to that taught at ISU and will count equally toward graduation.

ESTEC courses 0103 through 0108L are designed to allow students the opportunity to take segments of the curriculum in circumstances where they may already have some competencies resulting from prior courses, work experience, or taken by high school students for dual enrollment credits.

Completion of the first seven courses (ESET 0103 through ESET 0106 and their associated labs) constitutes equivalence to ESET 0141, ESET 0101, and ESET 0101L.

Completion of the last four courses (ESET 0107 through ESET 0108L) constitutes equivalency to ESET 0142, ESET 0102, and ESET 0102L.

Students should be familiar with AC and DC electronic and electrical applications, electrical power circuits, and electrical circuit analysis. General knowledge of electrical power transmission and distribution protection and controls is required. Students should also have working knowledge of control systems, data acquisition, and electrical sensors.

ESTEC currently offers one Basic Technical Certificate, two Intermediate Technical Certificates, and six Associate of Applied Science degrees that integrate the education and training required for graduates to maintain existing energy systems as well as to install, configure, and test components in newly constructed facilities.

The Associate of Applied Science programs include:

- Energy Systems Electrical Engineering Technology
- Energy Systems Instrumentation Engineering Technology
- Energy Systems Mechanical Engineering Technology
- Energy Systems Nuclear Operations Technology
- Cyber-Physical Security
- Industrial Controls
- Energy Systems Wind Engineering Technology (Inactive)

The Basic Technical Certificate program includes:

- Instrumentation and Automation Assistant

The Intermediate Technical Certificate programs include:

- Energy Systems Technology
- Cyber-Physical Security
- Energy Systems Renewable Energy Technology (Inactive)

Basic Technical Certificate: Instrumentation and Automation Assistant

(1 Year)

Objective:

To prepare students as entry-level technician and maintenance assistants to meet the needs of the electrical and process industry.

Employers include food processing, mining, semiconductor, chemical, paper, steel, petroleum, utilities and manufacturing industries. Graduates will have theoretical knowledge and hands-on experience setting up and calibrating electronic devices that measure and control temperature, level, flow, pressure, motion, force, humidity and acidity.

Graduates will be able to troubleshoot single and three phase motor controls, basic variable frequency drives, programmable logic controllers, sensors, relays, timers, solenoids, and other automation devices.

Required Courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESET 0103</td>
<td>Introduction to Electronics Theory</td>
<td>1</td>
</tr>
<tr>
<td>ESET 0103L</td>
<td>Introduction to Electronics Lab</td>
<td>1</td>
</tr>
<tr>
<td>ESET 0104</td>
<td>DC Electronics Principles Theory</td>
<td>2</td>
</tr>
<tr>
<td>ESET 0104L</td>
<td>DC Electronics Principles Lab</td>
<td>2</td>
</tr>
<tr>
<td>ESET 0105</td>
<td>AC Electronics Principles Theory</td>
<td>4</td>
</tr>
<tr>
<td>ESET 0105L</td>
<td>AC Electronics Principles Lab</td>
<td>2</td>
</tr>
<tr>
<td>INST 0140</td>
<td>Introduction to Motors and Motor Control Theory</td>
<td>2</td>
</tr>
<tr>
<td>INST 0220</td>
<td>Introduction to Programmable Logic Controllers</td>
<td>3</td>
</tr>
<tr>
<td>INST 0240</td>
<td>Theory</td>
<td>2</td>
</tr>
<tr>
<td>INST 0242</td>
<td>Theory</td>
<td>2</td>
</tr>
<tr>
<td>INST 0251</td>
<td>Laboratory</td>
<td>1</td>
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<tr>
<td>INST 0253</td>
<td>Laboratory</td>
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<tr>
<td>INST 0254</td>
<td>Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
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<td>24</td>
</tr>
</tbody>
</table>

Intermediate Technical Certificate: Cyber-Physical Security

(1 Year)

Objective:

Graduates will be able to: (1) exhibit knowledge of the need and purpose of cyber-physical security; (2) identify various cyber-physical system weaknesses and how to safeguard them; (3) adhere to nationally standardized procedures for evaluating cyber-physical security systems; (4) work and communicate effectively in multidisciplinary teams in both industrial and academic settings; and (5) understand current professional issues and the need to pursue lifelong learning.

Students must have completed a previous degree relating to Computer Science and meet ESTEC acceptance requirements.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESET 0100</td>
<td>Engineering Technology Orientation</td>
<td>1</td>
</tr>
<tr>
<td>ESET 0100L</td>
<td>Engineering Technology Orientation Lab</td>
<td>1</td>
</tr>
<tr>
<td>ESET 0103</td>
<td>Introduction to Electronics Theory</td>
<td>1</td>
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<tr>
<td>ESET 0103L</td>
<td>Introduction to Electronics Lab</td>
<td>1</td>
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<tr>
<td>ESET 0104</td>
<td>DC Electronics Principles Theory</td>
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</tr>
<tr>
<td>ESET 0104L</td>
<td>DC Electronics Principles Lab</td>
<td>2</td>
</tr>
<tr>
<td>ESET 0110</td>
<td>Introduction to Process Control</td>
<td>1</td>
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<tr>
<td>ESET 0110L</td>
<td>Introduction to Process Control Lab</td>
<td>1</td>
</tr>
<tr>
<td>ESET 0120</td>
<td>Introduction to Energy Systems</td>
<td>2</td>
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<tr>
<td>ESET 0120L</td>
<td>Introduction to Energy Systems Lab</td>
<td>1</td>
</tr>
<tr>
<td>ESET 0223</td>
<td>Digital Control Theory</td>
<td>2</td>
</tr>
<tr>
<td>ESET 0227</td>
<td>Digital Control Systems Laboratory</td>
<td>1</td>
</tr>
</tbody>
</table>
(1 Year)

Description:
Fundamental electronics, electrical, and energy systems program.

Objective:
To prepare students as entry-level technician and maintenance assistants to meet the needs of the electrical and process industry.

Associate of Applied Science Degree: Energy Systems Electrical Engineering Technology
(2 Years)

Objective:
Graduates will be able to: (1) solve technical problems typical of those encountered in the energy systems electrical engineering technology discipline by using critical thinking skills, current technology, and principles of mathematics and applied science; (2) work and communicate effectively in multidisciplinary teams in both industrial and academic settings; and (3) understand current professional issues and the need to pursue lifelong learning.

Students must register concurrently for the lab course associated with each theory course.

(1 Year)

Applications for this program are not currently being accepted.

Objective:
Graduates will be able to: (1) solve technical problems typical of those encountered in the energy systems renewable energy technology discipline by using critical thinking skills, current technology, and principles of mathematics and applied science; (2) work and communicate effectively in multidisciplinary teams in both industrial and academic settings; and (3) understand current professional issues and the need to pursue lifelong learning.

Required Courses:
Students must register concurrently for the lab course associated with each theory course.
Required Courses:
Students must register concurrently for the lab course associated with each theory.

Students must register concurrently for the lab course associated with each theory.

Additional General Education courses

Total Hours 76-77

1. See General Education Requirements (minimum 15 credits) for A.A.S. Degree at the start of the College of Technology section of the catalog.

Associate of Applied Science Degree: Energy Systems Instrumentation Engineering Technology
(2 Years)

Objective:
Graduates will be able to: (1) solve technical problems typical of those encountered in the energy systems instrumentation engineering technology discipline by using critical thinking skills, current technology, and principles of mathematics and applied science; (2) work and communicate effectively in multidisciplinary teams in both industrial and academic settings; and (3) understand current professional issues and the need to pursue lifelong learning.

Graduates will have a fundamental knowledge of energy systems, thermodynamics, electronics and electrical systems. They will have extensive hands-on experience setting up and troubleshooting single and three-phase motor controls, variable frequency drives, programmable logic controllers, sensors, relays, timers, solenoids, and human machine interface stations. They will be able to install, troubleshoot and calibrate instrumentation that measures and controls temperature, level, flow, pressure and other process variables.

Students must register concurrently for the lab course associated with each theory.

Required Courses:

ESET 0100 Engineering Technology Orientation 1
ESET 0100L Engineering Technology Orientation Lab 1
ESET 0101 Electrical Circuits I 5
ESET 0101L Electrical Circuits I Laboratory 5
ESET 0102 Electrical Circuits II 5
ESET 0102L Electrical Circuits II Laboratory 5
ESET 0110 Introduction to Process Control 1
ESET 0110L Introduction to Process Control Laboratory 1
ESET 0141 Applied Mathematics I 4
ESET 0142 Applied Mathematics II 4
INST 0281 Electrical Automation Theory 8
INST 0282 Electrical Automation Laboratory 5
INST 0292 Process Measurement and Control Theory 10
INST 0293 Process Measurement and Control Laboratory 4
TGE 0159 Internship Strategies 1

General Education courses

COMM 1101 Principles of Speech 2 3
MATH 1153 Introduction to Statistics 2 3
or MATH 1170 Calculus I
PHYS 1101 Elements of Physics 4
& 1101L Elements of Physics Laboratory 2
or CHEM 1100 Architecture of Matter 6

Additional General Education courses

Total Hours 76

1. See General Education Requirements (minimum 15 credits) for A.A.S. Degree at the start of the College of Technology section of the catalog.

2. Contributes to a General Education requirement.

Associate of Applied Science Degree: Energy Systems Mechanical Engineering Technology
(2 Years)

Objective:
Graduates will be able to: (1) solve technical problems typical of those encountered in the energy systems mechanical engineering technology discipline by using critical thinking skills, current technology, and principles of mathematics and applied science; (2) work and communicate effectively in multidisciplinary teams in both industrial and academic settings; and (3) understand current professional issues and the need to pursue lifelong learning.

Students must register concurrently for the lab course associated with each theory.

Required Courses:

ESET 0100 Engineering Technology Orientation 1
ESET 0100L Engineering Technology Orientation Lab 1
ESET 0121 Basic Electricity and Electronics 4
ESET 0121L Basic Electricity and Electronics Laboratory 4
ESET 0122 Electrical Systems and Motor Control Theory 2
ESET 0122L Electrical Systems and Motor Control Laboratory 2
ESET 0125 Introduction to Structural Welding 1
ESET 0126 Introduction to Mechanical Drafting and Computer Aided Design 1
ESET 0127 Mechanical Power Transmission 4
ESET 0127L Mechanical Power Transmission Laboratory 3
ESET 0141 Applied Mathematics I 4
ESET 0142 Applied Mathematics II 4
ESET 0220 Thermal Cycles and Heat Transfer 2
ESET 0221 Boiler Reactor and Turbine Principles 2
ESET 0240 Pumps 3
ESET 0240L Pump Applications Laboratory 3
ESET 0241 Valves and Piping 3
ESET 0241L Valves and Piping Applications Lab 2
ESET 0242 Process Measurements for Mechanical Engineering Technology 2
ESET 0243 Hydraulic and Pneumatic Power 2

1. See General Education Requirements (minimum 15 credits) for A.A.S. Degree at the start of the College of Technology section of the catalog.

2. Contributes to a General Education requirement.
### Associate of Applied Science Degree: Energy Systems Nuclear Operations Technology

**Objective:**
Graduates will be able to: (1) solve basic technical problems typical of what is encountered when working at a nuclear power plant; (2) perform tests and experiments, data analysis, and report findings including recommendations for improvement; (3) work and communicate effectively in diverse and multidisciplinary teams; and (4) be aware of modern professional, ethical, and societal issues as well as recognize the need for lifelong learning.

Students must register concurrently for the lab course associated with each theory course.

#### Required Courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESET 0100</td>
<td>Engineering Technology Orientation</td>
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<td>ESET 0101</td>
<td>Electrical Circuits I</td>
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<td>ESET 0101L</td>
<td>Electrical Circuits I Laboratory</td>
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</tr>
<tr>
<td>ESET 0102</td>
<td>Electrical Circuits II</td>
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<td>ESET 0102L</td>
<td>Electrical Circuits II Laboratory</td>
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<tr>
<td>ESET 0141</td>
<td>Applied Mathematics I</td>
<td>4</td>
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<td>ESET 0142</td>
<td>Applied Mathematics II</td>
<td>4</td>
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<tr>
<td>ESET 0151</td>
<td>Nuclear Industry Fundamental Concepts</td>
<td>4</td>
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<td>ESET 0151L</td>
<td>Nuclear Industry Fundamental Concepts Lab</td>
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<td>ESET 0200</td>
<td>Thermal Cycles and Heat Transfer</td>
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</tr>
<tr>
<td>ESET 0221</td>
<td>Boiler Reactor and Turbine Principles</td>
<td>2</td>
</tr>
<tr>
<td>ESET 0222</td>
<td>Process Control Theory</td>
<td>3</td>
</tr>
<tr>
<td>ESET 0226</td>
<td>Process Control Devices Laboratory</td>
<td>1</td>
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<tr>
<td>ESET 0248</td>
<td>Power Plant Drawings</td>
<td>3</td>
</tr>
<tr>
<td>ESET 0150</td>
<td>Internship Strategies</td>
<td>1</td>
</tr>
<tr>
<td>ESET 0159</td>
<td>Internship Strategies</td>
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#### General Education courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>CHEM 1100</td>
<td>Architecture of Matter</td>
<td>4</td>
</tr>
<tr>
<td>or PHYS 1101/1101L</td>
<td>Elements of Physics</td>
<td>3</td>
</tr>
<tr>
<td>COMM 1101</td>
<td>Principles of Speech</td>
<td>3</td>
</tr>
<tr>
<td>MATH 1153</td>
<td>Introduction to Statistics</td>
<td>2</td>
</tr>
<tr>
<td>or MATH 1170</td>
<td>Calculus I</td>
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</table>

#### Additional General Education courses

Total Hours: 79-80

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1. See General Education Requirements (http://coursecat.isu.edu/undergraduate/technology) (minimum 15 credits) for A.A.S. Degree at the start of the College of Technology section of the catalog.
2. Contributes to a General Education requirement.

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### Associate of Applied Science Degree: Energy Systems Wind Engineering Technology

**Objective:**
Graduates will be able to: (1) solve technical problems typical of those encountered in the energy systems wind engineering technology discipline by using critical thinking skills, current technology, and principles of mathematics and applied science; (2) work and communicate effectively in multidisciplinary teams in both industrial and academic settings; and (3) understand current professional issues and the need to pursue lifelong learning.

Students must register concurrently for the lab course associated with each theory course.

#### Required Courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESET 0100</td>
<td>Engineering Technology Orientation</td>
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<tr>
<td>ESET 0121</td>
<td>Basic Electricity and Electronics</td>
<td>4</td>
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<td>ESET 0121L</td>
<td>Basic Electricity and Electronics Laboratory</td>
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</tr>
<tr>
<td>ESET 0122</td>
<td>Electrical Systems and Motor Control Theory</td>
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</tr>
<tr>
<td>ESET 0122L</td>
<td>Electrical Systems and Motor Control Theory Laboratory</td>
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</tr>
<tr>
<td>ESET 0123</td>
<td>Mechanical Power Transmission</td>
<td>2</td>
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<tr>
<td>ESET 0123L</td>
<td>Mechanical Power Transmission Laboratory</td>
<td>4</td>
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<td>ESET 0141</td>
<td>Applied Mathematics I</td>
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<tr>
<td>ESET 0142</td>
<td>Applied Mathematics II</td>
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<tr>
<td>ESET 0150</td>
<td>Introduction to Wind Energy Systems</td>
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<tr>
<td>ESET 0150L</td>
<td>Introduction to Wind Energy Systems Laboratory</td>
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#### General Education courses

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<th>Hours</th>
</tr>
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<tbody>
<tr>
<td>CHEM 1111</td>
<td>General Chemistry I</td>
<td>5</td>
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<tr>
<td>&amp; 1111L</td>
<td>General Chemistry I Lab</td>
<td>2</td>
</tr>
<tr>
<td>MATH 1153</td>
<td>Introduction to Statistics</td>
<td>4</td>
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<tr>
<td>or MATH 1170</td>
<td>Calculus I</td>
<td>4</td>
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<tr>
<td>PHYS 1101</td>
<td>Elements of Physics</td>
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<tr>
<td>&amp; 1101L</td>
<td>Elements of Physics Laboratory</td>
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</table>

#### Additional General Education courses

Total Hours: 81-82

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1. See General Education Requirements (minimum 15 credits) for A.A.S. Degree at the start of the College of Technology section of the catalog.
2. Contributes to a General Education requirement.
ESET 0212 Electrical Systems Documentation and Standards 1
ESET 0231 Microcontrollers 2
ESET 0231L Microcontrollers Laboratory 1
ESET 0232 Electrical Machines 3
ESET 0232L Electrical Machines Laboratory 3
ESET 0233 Electrical Power Systems 3
ESET 0233L Electrical Power Systems Laboratory 3
ESET 0240 Pumps 3
ESET 0240L Pump Applications Laboratory 3
ESET 0243 Hydraulic and Pneumatic Power 2
ESET 0243L Hydraulic and Pneumatic Power Laboratory 2
ESET 0247 Wind Energy Control Systems 2
ESET 0247L Wind Energy Control Systems Laboratory 1
TGE 0159 Internship Strategies 1

General Education courses

COMM 1101 Principles of Speech 2 3
MATH 1153 or MATH 1170 Introduction to Statistics 2 3-4
PHYS 1101 Elements of Physics 4
& 1101L Elements of Physics Laboratory 2

Additional General Education courses 6
Total Hours 75-76

1 See General Education Requirements (minimum 15 credits) for A.A.S. Degree at the start of the College of Technology section of the catalog.
2 Contributes to a General Education requirement.

Associate of Applied Science Degree: Cyber-Physical Security

(1 Semester)

Cyber-Physical Security is a second AAS degree available to students who have received an AAS degree related to ESTEC. Prospective students with other education or experience should contact the instructor prior to enrolling.

ESET 0281 Critical Infrastructure Data Security 3
ESET 0282 Wireless Network Security 3
ESET 0283 Information System Security Design 3
ESET 0284 Risk Management for Critical Data Systems 3
ESET 0285 Information System Reliability 3
ESET 0286 Critical Network Security 3

Total Hours 18

Objective:
Graduates will be able to: (1) solve technical problems typical of those encountered in the energy systems instrumentation engineering technology discipline by using critical thinking skills, current technology, and principles of mathematics and applied science; (2) work and communicate effectively in multidisciplinary teams in both industrial and academic settings; and (3) understand current professional issues and the need to pursue lifelong learning.

Required Courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>INST 0281</td>
<td>Electrical Automation Theory</td>
<td>8</td>
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<td>INST 0282</td>
<td>Electrical Automation Laboratory</td>
<td>5</td>
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<td>INST 0292</td>
<td>Process Measurement and Control Theory</td>
<td>10</td>
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<td>INST 0293</td>
<td>Process Measurement and Control Laboratory</td>
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<tr>
<td>CHEM 1100</td>
<td>Architecture of Matter</td>
<td>4</td>
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<tr>
<td>or PHYS 1101/1101L</td>
<td>Elements of Physics</td>
<td></td>
</tr>
<tr>
<td>Total Hours</td>
<td>31</td>
<td></td>
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</tbody>
</table>

Energy Sys Eng Tech Courses

ESET 0100 Engineering Technology Orientation: 1 semester hour.
An introduction to the opportunities and responsibilities of an engineering technician. Exposure to the various fields of technology through field trips, movies and guest lectures. Introduction to materials, techniques, and college services, which will assist the student in completing a technology program. F, S, D

ESET 0101 Electrical Circuits I: 5 semester hours.
Includes measurements and calculation of current, voltage, resistance and power in series, parallel and combination circuits with DC and AC power sources. Voltage and current in resistive-capacitive (R-C) and resistive-inductive (R-L) circuits during switch transitions, AC power circuits including reactance and transformation. Voltage and current in non-resonant and resonant AC circuits and filters. COREQ: ESET 0101L. F, S, D

ESET 0101L Electrical Circuits I Laboratory: 5 semester hours.
Electrical circuits are analyzed, designed and constructed using various DC and AC theories and electrical quantities are measured using appropriate test equipment. COREQ: ESET 0101. F, S, D

ESET 0102 Electrical Circuits II: 5 semester hours.
Continuation of electrical circuit study introducing the fundamentals of semiconductors, amplifier theory, digital logic and logical devices. COREQ: ESET 0102L. F, S, D

ESET 0102L Electrical Circuits II Laboratory: 5 semester hours.
Laboratory applications and experiments in troubleshooting of semiconductor devices and circuits, digital logic and logic device application. COREQ: ESET 0102. F, S, D

ESET 0103 Introduction to Electronics Theory: 1 semester hour.
Fundamentals of DC electronics - soldering, DC analysis, electrical units, Ohm's Law, series and parallel resistive circuits, and related algebraic principles. D
**ESET 0103L Introduction to Electronics Lab: 1 semester hour.**
Experiments in DC electronic circuits covered in ESET 0103, using electronic components, equipment, and tools. D

**ESET 0104 DC Electronics Principles Theory: 2 semester hours.**
Fundamentals of DC electronics - voltage and current, meters, network theorems, and related algebraic principles. D

**ESET 0104L DC Electronics Principles Lab: 2 semester hours.**
Experiments in DC electronic circuits analyzing voltage and current, meters, and network theorems. D

**ESET 0105 AC Electronics Principles Theory: 4 semester hours.**
Electronics AC fundamentals - magnetism, inductors, capacitors, AC-DC network analysis, and related algebraic principles. D

**ESET 0105L AC Electronics Principles Lab: 2 semester hours.**
Experiments in basic AC electronic circuits topics covered in ESET 0105, using electronic components, equipment, and tools to analyze current and voltage. D

**ESET 0106 Electronic Principles Capstone: 2-8 semester hours.**
Fundamentals of DC and AC electronics: safety, soldering, electrical units, Ohm's Law, series and parallel resistive circuits, voltage and current, meters, network theorems, magnetism, inductors, capacitors, and AC-DC network analysis. D

**ESET 0107 Principles of Control Devices Theory: 3 semester hours.**
Comprehensive study of semiconductors, power supplies, transistor amplifiers, operational amplifiers, and related algebraic principles. COREQ: ESET 0107L. PRE-or-COREQ: ESET 0106. D

**ESET 0107L Principles of Control Devices Lab: 3 semester hours.**
Experiments involving semiconductors, power supplies, transistor amplifiers, and operational amplifiers. COREQ: ESET 0107. PREREQ: ESET 0106. D

**ESET 0108 Principles of Digital Devices: 2 semester hours.**
Digital fundamentals including logic gates, Boolean algebra, combination logic circuits, digital registers, counters, and timing circuits, and related algebraic principles. COREQ: ESET 0108L. PREREQ: ESET 0106. D

**ESET 0108L Principles of Digital Devices Lab: 2 semester hours.**
Experiments involving digital fundamentals including logic gates, Boolean algebra, combination logic circuits, digital registers, counters, and timing circuits. COREQ: ESET 0108. PREREQ: ESET 0106. D

**ESET 0110 Introduction to Process Control: 1 semester hour.**
An introduction to the basic concepts of process control through the study of control devices, process variables, programmable logic controllers, instrument calibration, motor control, test equipment, and diagrams. PREREQ: ESET 0100. COREQ: ESET 0110L. F, S, D

**ESET 0110L Introduction to Process Control Laboratory: 1 semester hour.**
A laboratory introduction to the application and use of control devices, programmable logic controllers, and test equipment. Experiments with motor control, instrument calibration, and process control. PREREQ: ESET 0100L. COREQ: ESET 0110. F, S, D

**ESET 0120 Introduction to Energy Systems: 2 semester hours.**
Introduction to energy terminology, functions of power generation and mechanical processes, equipment, material, power cycles, mechanical physics and systems, and principles of heat transfer and fluid flow are covered. COREQ: ESET 0120L. F, D

**ESET 0120L Introduction to Energy Systems Laboratory: 1 semester hour.**
Laboratory exercises in the maintenance and function of selected plant equipment, mechanical perspective of primary process equipment, and their sub-components are covered. COREQ: ESET 0120. F, D

**ESET 0121 Basic Electricity and Electronics: 4 semester hours.**
Fundamental principles of electricity, Ohm's law, Kirchoff's laws, and circuit analysis applied to DC and AC circuits. COREQ: ESET 0121L. F, D

**ESET 0121L Basic Electricity and Electronics Laboratory: 4 semester hours.**
Basic principles of electrical measurement and testing of DC and AC circuits. COREQ: ESET 0121. F, D

**ESET 0122 Electrical Systems and Motor Control Theory: 2 semester hours.**
Introduction to electrical system distribution and basic motor control including two- and three-wire control using a variety of devices and motor magnetic controllers. Control relays, time relays, solenoid valves, latching relays, and motor control centers. PREREQ: ESET 0121 and ESET 0121L or permission of instructor. COREQ: ESET 0122L. S, D

**ESET 0122L Electrical Systems and Motor Control Theory Laboratory: 1 semester hour.**
Applications of electrical systems and motor controls. PREREQ: ESET 0121 and ESET 0121L or permission of instructor. COREQ: ESET 0122L. S, D

**ESET 0124 Mechanical Systems and Machine Design: 2 semester hours.**
Design considerations for machine elements used in mechanisms and machines, including advanced strength of materials; material selection; shaft design; selection of gear, chain, and belt drives; design and selection of bearings; design of brakes and clutches; and characteristics and selection of electric motors. D

**ESET 0125 Introduction to Structural Welding: 1 semester hour.**
An introduction to structural welding with an emphasis on carbon steel. Hands-on practice with cutting and joining through the use of hand-held torches and welders. F, D

**ESET 0126 Introduction to Mechanical Drafting and Computer Aided Design: 1 semester hour.**
An introduction to mechanical drafting and computer aided design. Course focuses on basic drafting skills and commonly used computer aided design software. This is a laboratory/lecture course. S, D

**ESET 0127 Mechanical Power Transmission: 4 semester hours.**
Introduction to machine kinetics, kinematics, and design. Drives, bearings, couplings, clutches, gears, and fluids used in the transmission of power in industrial processes are covered. PREREQ: ESET 0121, ESET 0121L, or permission of instructor. COREQ: ESET 0127L. S, D

**ESET 0127L Mechanical Power Transmission Laboratory: 3 semester hours.**
The application of drives, bearings, couplings, clutches, gears, and fluids used in the transmission of power in industrial processes are covered. Students will develop machine documentation and mechanical millwright skills. PREREQ: ESET 0121 and ESET 0121L, or permission of instructor. COREQ: ESET 0127L. S, D

**ESET 0141 Applied Mathematics I: 4 semester hours.**
Basic math as it applies to Electrical Theory; includes algebraic and trigonometric topics as they relate to DC and AC (sine wave) circuit analysis. COREQ: ESET 0101 or ESET 0121. F, S, D

**ESET 0142 Applied Mathematics II: 4 semester hours.**
Continuation of ESET 0141. Selected algebraic and trigonometric topics as related to DC and AC (sine wave) circuit analysis with special emphasis on trigonometric solution and vector analysis. COREQ: ESET 0102 or ESET 0127. F, S, D

**ESET 0150 Introduction to Wind Energy Systems: 2 semester hours.**
Investigate how wind power works, and its reliability, economics, and environmental implications. Discussion includes turbine types, their development, and their current status. The operating experiences and economic status of the industry will be evaluated. Students will be expected to carry out research and present reports on selected turbines. COREQ: ESET 0150L. F, D
ESET 0150L Introduction to Wind Energy Systems Laboratory: 1 semester hour.
Wind energy applications and basic operating principles. Laboratory exercises in maintenance and function of selected wind power systems and process. COREQ: ESET 0150. F, D

ESET 0151 Nuclear Industry Fundamental Concepts: 4 semester hours.
Introduces fundamental concepts used throughout the nuclear industry as an integral part of daily operations. Topics include Human Performance Enhancement (HPE) fundamentals, an introduction to the Systematic Approach to Training (SAT), conduct of On-The-Job training (OTJ) and Task Performance Evaluation (TPE), Foreign Material Exclusion (FME), and an overview of the FirstEnergy Nuclear Operating Corporation (FENOC) safety manual. COREQ: ESET 0151L. F

ESET 0151L Nuclear Industry Fundamental Concepts Lab: 1 semester hour.
Laboratory applications of nuclear industry operations. It includes OSHA compliance courses required by nuclear facilities. COREQ: ESET 0151. F

ESET 0160 Introduction to Renewable Energy: 4 semester hours.
An exploration of the technologies of renewable energy, emphasizing physical principles and practical applications of wind, solar, and biomass forms of energy production. COREQ: ESET 0160L. S, D

ESET 0160L Introduction to Renewable Energy Lab: 2 semester hours.
Application of principles and practical applications of wind, solar, and biomass forms of energy production. COREQ: ESET 0160. S, D

ESET 0161 Applications of Physics and Earth Science: 3 semester hours.
Concepts and applications of physics and earth science addressing the function of mechanics, heat, wave motion, electricity, magnetism, light and the dynamic aspects of weather and climate from global to local scales with emphasis on how these affect energy production and use. F, D

ESET 0162 Industrial Health and Safety: 2 semester hours.
An overview of legislation, worker's compensation, hazard recognition, and safety planning. Includes basic engineering solutions. Addresses employee safety training requirements, recordkeeping, safety inspections, and program planning in the construction industry. Includes First Aid training and responder certification. F, D

ESET 0199 Experimental Course: 1-6 semester hours.
This is an experimental course. The course title and number of credits are announced in the class schedule by the scheduling department. Experimental courses may be offered no more than three times with the same title and content.

ESET 0200 Applications of Electronic Electrical and Power Systems Control Fundamentals and Safety: 6 semester hours.
Overview and application of electronic sensors, thyristor power control circuits, and networks. Electrical motor control, relays, timers, PLCs, and computer software used to design and verify motor control circuits. Basic process control print reading and device calibration methods. Includes troubleshooting techniques and safety practices. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. Su, D

ESET 0201 Electronics for Instrumentation and Control: 2 semester hours.
Electronic theory and laboratory addressing the components, functions and configurations of power, multistage differential and operational amplifiers, oscillators, thyristors, power control and regulation circuits, sensors, and networks. Laboratory based learning experiences strengthen principles. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. Su, D

ESET 0202 Introduction to Fiber and Electro Optics: 2 semester hours.
Fundamental physics of fiber/electro-optics, electro-optical spectrum, EO detectors, and arrays, IR sources, IR optical systems, light transmission/propagation, nonlinear optics, laser bandwidth, power supplies, optical fibers, fiber installation, testing, and maintenance. Lecture/Laboratory. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. Su, D

ESET 0203 Fundamentals of Electrical Generation: 2 semester hours.
Introduction to generator and prime mover principles covering major sources of utility generation. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. F, D

ESET 0204 Process Control Devices: 2 semester hours.
Electronic control device theory and laboratory including sensors, device communication, controller fundamentals, control loops and loop tuning, device and system calibration and diagnostics, heat transfer, fluid flow, and refrigeration control. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. Su, D

ESET 0205 Fundamentals of Control Logic: 2 semester hours.
Introduction to control logic, relay logic principles, electronics in logic, logic and control drawings, fundamentals of programmable logic controllers (PLCs), and electrical automation concepts. Lecture/Laboratory. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. Su, D

ESET 0206 Health and Safety in Power Generation: 1 semester hour.
Regulatory and practical considerations of occupational health and safety associated with working with power generation systems. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. Su, D

ESET 0210 Principles of Power Generating Systems: 2 semester hours.
Transmission lines, generator and transformer characteristics, and fault detection and correction. Emphasis on circuit performance addressing voltage regulation, power factor, and protection devices. Lecture/Laboratory. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. F, D

ESET 0211 Sensors and Control Devices: 2 semester hours.
Theory and application of control devices, sensors, timers, relays. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. F, D

ESET 0212 Electrical Systems Documentation and Standards: 1 semester hour.
Introduction to print reading, technical specifications, print annotation, report writing, and electrical codes. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. F, D

ESET 0213 Motors Generators and Industrial Electrical Systems: 2 semester hours.
The construction, design aspects and theory of operation of DC, single and poly-phase motors, variable frequency motor control, electrical switch-boards and electrical distribution systems. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. F, D

ESET 0214 Motor Control Laboratory: 1 semester hour.
Applications of AC and DC motor control theory and motor protection systems. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. F, D

ESET 0215 Controller Laboratory: 1 semester hour.
Applications of Programmable Logic Controllers and DCS including I-O configuration, Ladder logic design and function block use. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. F, D
ESET 0216 Sensors and Control Device Laboratory: 1 semester hour. Laboratory applications of sensors (including photoelectric and proximity types), relay and timer circuits, and application of automation devices. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. F, D

ESET 0217 Motor Generator and Electrical Systems Laboratory: 2 semester hours. Installation, setup, control, maintenance, and troubleshooting of AC and DC motors, electrical device installations and industrial safety and proper tool usage. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. F, D

ESET 0218 Discrete Control Systems: 2 semester hours. Discrete control concepts of power system operation including motor operated valve control, turbine sequencing and electrical system protection. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. F, D

ESET 0220 Thermal Cycles and Heat Transfer: 2 semester hours. Introduction to the Rankin, Carnot, and Brayton cycles. Includes principles of heat transfer and fluid flow and thermodynamic principles. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. S, D

ESET 0221 Boiler Reactor and Turbine Principles: 2 semester hours. Survey of various boiler types and principles of combustion, overview of reactor principles and steam generation, turbine types and principles of operation. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. S, D

ESET 0222 Process Control Theory: 3 semester hours. Electronic instruments-sensors, indicators, transmitters, computing relays, electro-optics, electronic controllers, ratio control, cascade control, recorders, analytical equipment, troubleshooting. COREQ: ESET 0226. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. S, D

ESET 0223 Digital Control Theory: 2 semester hours. Digital systems, digital control, analog-to-digital and digital-to-analog interfacing, signal conditioning, programmable controllers, computer application. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. S, D

ESET 0224 Measurement Theory: 2 semester hours. Calibration calculations, pressure scales, level considerations, specific gravity, elevation suppression, closed and open systems, temperature scales, thermocouple and RTD values, bulb and capillary devices, heat transfer, flow with square root linearization, gas flow measurement calculations, mass flow, humidity measurements, PH measurements. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. S, D

ESET 0225 Instrument Calibration Laboratory: 1 semester hour. Use of test equipment, power supplies, current and volt measurements, use of oscilloscope, capacitor checker, decade box, Wheatstone bridge, transmitter simulator, manometers, pressure calibration devices. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. S, D

ESET 0226 Process Control Devices Laboratory: 1 semester hour. Set up, maintenance and troubleshooting of electronic sensors, indicators, transmitters, relays recorders, and controllers, transmission with twisted pair, fiber optics, smart systems, and analytical equipment. COREQ: ESET 0222. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. S, D

ESET 0227 Digital Control Systems Laboratory: 1 semester hour. Computer and programmable controller interfacing with transmitters and final elements, PID loops, auto tuning, set up to complete control loops, computer graphics. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. S, D

ESET 0228 Measurements Laboratory: 1 semester hour. Calibration of transmitters, simulation of process variables, temperature, pressure, level flow, and humidity control loops. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. S, D

ESET 0230 Communication Circuits: 2 semester hours. Communication and various types of data and information transfer circuits. Analysis of the various types of communication available and their principles of operation. COREQ: ESET 0230L. F, D

ESET 0230L Communications Circuits Laboratory: 1 semester hour. Laboratory applications and explorations of various communication circuit types. Includes installation and maintenance considerations of the various types of communication available. COREQ: ESET 0230. F, D

ESET 0231 Microcontrollers: 2 semester hours. Principles of motor controls, microcontroller and programmable logic controller (PLC) programming including I/O devices and integration of process control principles. COREQ: ESET 0231L. F, D

ESET 0231L Microcontrollers Laboratory: 1 semester hour. Applications of motor controls, microcontroller and programmable logic controller (PLC) programming, including I/O device connections and interface to final elements of process control systems. COREQ: ESET 0231. F, D

ESET 0232 Electrical Machines: 3 semester hours. Energy storage, transfer, and conversion, force and emf production, coupled circuit analysis of systems with both electrical and mechanical inputs. Applications to electric motors and generators and other electromechanical transducers. COREQ: ESET 0232L. F, D

ESET 0232L Electrical Machines Laboratory: 3 semester hours. Laboratory applications of electrical machines including testing, evaluation and industry best practices for installation and troubleshooting. COREQ: ESET 0232. F, D

ESET 0233 Electrical Power Systems: 3 semester hours. The electric power industry, operation of power systems, load flow, fault calculations, economic dispatch and general technical problems of electric power networks. COREQ: ESET 0233L. S, D

ESET 0233L Electrical Power Systems Laboratory: 3 semester hours. Applications and laboratory studies of power network principles, equipment application and device evaluation. COREQ: ESET 0233. S, D

ESET 0235 Power Electronic Circuits: 2 semester hours. Electronic theory addressing power electronic components, functions and configurations of power, multistage differential and operational amplifiers, oscillators, thyristors, power control and regulation circuits, sensors and networks. COREQ: ESET 0235L. S, D

ESET 0235L Power Electronic Circuits Laboratory: 1 semester hour. Electronic laboratory addressing the components, functions and configurations of power, multistage differential and operational amplifiers, oscillators, thyristors, power control and regulation circuits, sensors and networks. COREQ: ESET 0235. S, D
ESET 0240 Pumps: 3 semester hours.
Introductory fluid concepts that pertain to centrifugal pumps, including pump seals, packing techniques, and bearings are covered. Includes the operation and maintenance of various industrial pump types. Emphasis is placed on centrifugal pump maintenance and repair. PREREQ: ESET 0127 and ESET 0127L or permission of instructor. COREQ: ESET 0240L. F, D

ESET 0240L Pump Applications Laboratory: 3 semester hours.
Applications in the installation, testing, and maintenance of various pump types. PREREQ: ESET 0123 and ESET 0123L or permission of instructor. COREQ: ESET 0240. F, D

ESET 0241 Valves and Piping: 3 semester hours.
Introduction to basic construction, components, materials, and function of piping and valves common to power generation, industrial, and commercial systems, including valve process control. PREREQ: ESET 0127 and ESET 0127L or permission of instructor. COREQ: ESET 0241L. F, D

ESET 0241L Valves and Piping Applications Lab: 2 semester hours.
Applications of valve and piping installation, layout, and maintenance including valve disassembly, reassembly, maintenance, and quality control practices. Valve control system maintenance and operation are covered. PREREQ: ESET 0127 and ESET 0127L or permission of instructor. COREQ: ESET 0241. F, D

ESET 0242 Process Measurements for Mechanical Engineering Technology: 2 semester hours.
Principles of temperature, pressure, strain, flow, force, and vibration measurements are covered. Techniques of computerized data acquisition, reduction, and statistical precision and tolerance are reviewed. Lecture plus laboratory work in selected topics. F, D

ESET 0243 Hydraulic and Pneumatic Power: 2 semester hours.
Hydraulic and pneumatic power mechanics covering high pressure fluids and the associated power and control systems with symbology, circuit operation, and terminology are covered. PREREQ: ESET 0127 and ESET 0127L or permission of instructor. COREQ: ESET 0243L. F, D

ESET 0243L Hydraulic and Pneumatic Power Laboratory: 2 semester hours.
Applications of hydraulic and pneumatic power mechanics with hands-on experience are covered. PREREQ: ESET 0127 and ESET 0127L or permission of instructor. COREQ: ESET 0243. F, D

ESET 0244 Rotating Equipment and Millwright Maintenance: 4 semester hours.
Installation and predictive maintenance techniques that include installations, operation, vibration analysis, lubrication, trend analysis, and troubleshooting techniques are covered. Machine, shaft, and gear alignment practices and methods are discussed. COREQ: ESET 0244L. PREREQ: ESET 0127 or permission of instructor. S, D

ESET 0244L Rotating Equipment and Millwright Maintenance Laboratory: 3 semester hours.
Applications and use of tools and equipment used in the reliability maintenance process. Includes the use of precision maintenance and alignment tools, vibration data collection, oil analysis, and infrared testing. COREQ: ESET 0244. PREREQ: ESET 0127 or permission of instructor. S, D

ESET 0245 Fundamentals of Heat Exchangers: 2 semester hours.
Introduction to construction, operation, and maintenance of various heat exchangers. Includes flow patterns, temperature profiles, and analysis techniques to determine performance and efficiency. S, D

ESET 0246 Materials and Metallurgy: 2 semester hours.
Lecture, demonstration, and laboratory emphasizing the practical approach to basic principles of materials and metallurgical science, including behavior of materials under various conditions. S, D

ESET 0247 Wind Energy Control Systems: 2 semester hours.
Measurement and control of mechanical and electrical systems, techniques of computerized data acquisition and reduction, electrical interconnection issues, technical challenges, safety issues, and metering associated with renewable resource generation. Discussion of operation, dispatch, and control of wind systems their management and planning. PREREQ: ESET 0231 and ESET 0231L or permission of instructor. COREQ: ESET 0247L. S, D

ESET 0247L Wind Energy Control Systems Laboratory: 1 semester hour.
Applications measurement and control of mechanical and electrical systems used in wind energy. PREREQ: ESET 0231 and ESET 0231L or permission of instructor. COREQ: ESET 0247. S, D

ESET 0248 Power Plant Drawings: 3 semester hours.
Covers the use of and relationship among typical drawings found at a nuclear power plant. Topics include using mechanical, electrical, and isometric drawings; the information contained in the lead sheet of a set of drawings; the use of notes and legends; standard symbology used in engineering drawings; and the use of various types of drawings together in order to perform work, locate components, or use for other typical applications. PREREQ: ESET 0151 and ESET 0151L. F

ESET 0249 Reactor Plant Materials: 3 semester hours.
Provides an understanding of the various materials used in the operation of a nuclear power plant. Topics include phase equilibria of materials, mechanical properties and behavior of materials, environmental effects on materials, and nuclear specific topics such as fuel pellets, fuel rod cladding, control rods, radiation effects on materials, enrichment of radioactive isotopes, and fuel pellet fabrication. PREREQ: ESET 0151 and ESET 0151L. F

ESET 0250 Radiation Detection and Protection: 3 semester hours.
The theory, application, detection, and shielding of the various types of radiation. Includes detection devices such as typical survey meters, core power detectors, and personnel monitoring devices. Discussion of how exposure to radiation can be minimized and the biological impact of radiation. PREREQ: ESET 0151 and ESET 0151L. F

ESET 0251 Reactor Theory Safety and Design: 3 semester hours.
Provides an understanding of the principles of reactor theory, including the fission process; the neutron life cycle; the concepts of subcritical multiplication, criticality and reactivity; thermal limits and their importance to operation; the functions and construction of fission product barriers; the practical application of the concepts of defense in depth and redundancy; and the roles of the various employees in reactor safety. PREREQ: ESET 0248, ESET 0249, and ESET 0250. S

ESET 0252 Power Plant Components: 3 semester hours.
Introduces fundamental components and pieces of equipment that are used throughout electrical power generating facilities such as pumps, valves, heat exchangers, motors, and generators. Includes purpose, construction, theory of operation, and typical maintenance requirements of these devices. PREREQ: ESET 0248, ESET 0249, and ESET 0250. S

ESET 0253 Introduction to the Smart Electric Power Grid: 2 semester hours.
Overview of the technologies used in Smart Grid to enhance reliability, security, robustness and efficiency of transmission and distribution systems. The course addresses advanced metering infrastructure, home-area networks, micro-grids, real-time pricing, plug-in hybrid vehicles, demand response, and load curve shaping. Included is an in-depth look at the Smart Grid’s benefits and potential impact on our energy consumption. COREQ: ESET 0254, ESET 0255, ESET 0256, ESET 0257, ESET 0258, ESET 0259. PREREQ: Smart Grid major or instructor approval. F
ESET 0254 Smart Grid Design and Integration: 2 semester hours.
Overview of Smart Grid design including combination of technology, utility, and consumer considerations. The rapid changes in communications and power infrastructure in the grid will be presented. Included are Smart Grid applications such as Demand Response, real-time pricing, Home Area Networks, Advanced Metering Systems, smart loads and applicances. COREQ: ESET 0253, ESET 0255, ESET 0256A, ESET 0257, ESET 0258, and ESET 0259. F

ESET 0255 Electric Power Transmission and Distribution Systems: 3 semester hours.
Essential information regarding the transmission and distribution of electric power, including components of transmission lines, transformers and switchgear, substations, and electric power distribution systems. Wide-ranging information related to electric service loads as well as operational aspects and costs involved in transmitting and distributing electric power. The potential trends of electric power transmission are also discussed. COREQ: ESET 0253, ESET 0254, ESET 0256A, ESET 0257, ESET 0258, and ESET 0259. F

ESET 0256A Renewable Electrical Energy and Grid Integration: 2 semester hours.
Assesses existing renewable resources such as wind, solar, geothermal, hydro, tidal, wave power, and biomass and their integration into the electric power grid and various energy storage methods to accommodate the intermittent nature of these resources. Economic constraints, environmental benefits, and institutional regulations are considered. COREQ: ESET 0253, ESET 0254, ESET 0255, ESET 0257, ESET 0258, and ESET 0259. F

ESET 0257 Fundamentals of Modern Protective Relaying: 3 semester hours.
Provides a comprehensive understanding of the principles of digital power system relaying and protection applications. Examines the major components of a power system as well as basic theory and protection principles. COREQ: ESET 0253, ESET 0254, ESET 0255, ESET 0256A, ESET 0257, ESET 0258, and ESET 0259. F

ESET 0258 Smart Grid Command and Control: 3 semester hours.
Smart Grid is built upon the concept of computerized command and control over a parallel data network to improve efficiency and reliability of electrical power distribution. This course builds understanding of the control network from the generation site to the end appliance in a residential home, including networking theory, efficacy of various radio technologies, protocols, and security issues. COREQ: ESET 0253, ESET 0254, ESET 0255, ESET 0256A, ESET 0257, and ESET 0259. F

ESET 0259 SCADA and Telemetry: 5 semester hours.
Explains the parts and technologies that make up a Supervisory Control and Data Acquisition (SCADA) system and provides tools used in applying the technology to Smart Grid. This course addresses the various components of a SCADA system including sensor and telemetry components, the background and history of component technologies, and the base standards that apply to SCADA installations. In this course students will design a SCADA system for potential application in Smart Grid, identify the limitations of SCADA systems and vulnerabilities of the design, determine the "scan time" required for SCADA systems of various sizes, and evaluate the Human Machine Interface requirements for the system. COREQ: ESET 0253, ESET 0254, ESET 0255, ESET 0256A, ESET 0257, and ESET 0258. F

ESET 0270 Foundations and Principles of Robotic Operation: 2 semester hours.
Mechanics of robotic manipulator/control systems, programming of robot actions, application and troubleshooting techniques of solid-state devices used in logic controlled systems. Principles of industrial measurement/control, robotics, machine language, and A-D/D-A conversion. D

ESET 0271 Radio Frequency and Telecommunications Systems I: 7 semester hours.
Addresses the specific needs of individuals for theoretical study of radio frequency/telecommunications circuits, RF wideband and narrow band amplifiers, electronic switching/programming and digital data communications systems that utilizes laboratory information from ESET 0272. RF/Telecommunications test equipment, radio frequency generation, reception, amplification, modulation, and radiation at appropriate intervals through the HF, VHF, UHF, and SHF radio frequency spectrum. D

ESET 0272 Radio Frequency and Telecommunications I Laboratory: 7 semester hours.
Practical application of radio frequency/telecommunications circuits, RF wideband and narrow band amplifiers, electronic switching/programming and digital data communications that utilizes theory studied in ESET 0271. RF/telecommunication test equipment, radio frequency generation, reception, amplification, modulation and radiation at appropriate intervals through the HF, VHF, UHF, and SHF radio frequency spectrum. D

ESET 0273 Radio Frequency and Telecommunications Systems II: 6 semester hours.
Theoretical application of radio frequency/telecommunications circuits, electronic switching/programming and digital data communications utilizing laboratory/experiments developed in ESET 0274. RF/telecommunication test equipment, mobile telephone, carrier fundamentals, repeater systems, fiber optic principles, microwave, antennas and transmission line system concepts are emphasized. D

ESET 0274 Radio Frequency and Telecommunications Laboratory II: 3 semester hours.
Practical application of radio frequency/telecommunications utilizing ESET 0273, Radio Frequency/Telecommunications Systems II. RF/Telecommunication test equipment, mobile telephone carrier fundamentals, repeater systems, fiber optic principles, microwave, antennas, and transmission line systems concepts are emphasized. D

ESET 0275 Radio Frequency and Telecommunications Laboratory III: 3 semester hours.
Continuation of ESET 0274. D

ESET 0276 Coop: 1-4 semester hours.
Students pursue on-the-job training in the electronic information systems industry which satisfies competencies in lieu of radio frequency/telecommunications lab. A Coop agreement must be signed by all parties involved, i.e., student, instructor, and employer. D

ESET 0280 Capstone and Case Studies in Nuclear Engineering Technology: 2 semester hours.
An examination of case studies from the nuclear power industry and from other industries. Discussion of precursors to poor decision making and how the proper use of human performance enhancement (HPE) and event free tools can minimize the risks of accidents. PREREQ: ESET 0248, ESET 0249, and ESET 0250. S

ESET 0281 Critical Infrastructure Data Security: 3 semester hours.
Introduction to data security issues including basic encryption and decryption techniques and secure encryption systems. Study includes cryptographic protocols and practices, security in networks and distributed systems and legal and ethical issues in computer security. COREQ: ESET 0282, ESET 0283, ESET 0284, ESET 0285, and ESET 0286. PREREQ: Prior AAS in an Energy System program or instructor approval. S, D
ESET 0282 Wireless Network Security: 3 semester hours.
Overview of wireless networks with a focus on threats, discussion of proposed solutions and their limitations. Topics will include authentication, secure handoffs, key management in wireless networks, attacks on MAC protocols, selfish and malicious behavior in wireless routing protocols, secure multicast. COREQ: ESET 0281, ESET 0283, ESET 0284, ESET 0285, and ESET 0286. PREREQ: Prior AAS in Energy System program or instructor approval. S, D

ESET 0283 Information System Security Design: 3 semester hours.
Examination of the design methods and techniques for the development of safety and security critical information systems. Secure software design and implementation and information infrastructure maintenance and reliability are examined. An overview of the development of specification, design and analysis of mission-critical system attributes. COREQ: ESET 0281, ESET 0282, ESET 0284, ESET 0285, and ESET 0286. PREREQ: Prior AAS in Energy System program or instructor approval. S, D

ESET 0284 Risk Management for Critical Data Systems: 3 semester hours.
Risk analysis and threat profiling for mission critical information systems. Adversarial analysis and countermeasure synthesis processes are studied. Policy development and implementation strategies and Incident handling and response procedures are discussed. COREQ: ESET 0281, ESET 0282, ESET 0283, ESET 0285, and ESET 0286. PREREQ: Prior AAS in an Energy System program or instructor approval. S, D

ESET 0285 Information System Reliability: 3 semester hours.
Design and analysis methods for high security control and data systems. System reliability and security requirements. Specification of mission-critical system properties. Software and hardware validation, verification, and certification. COREQ: ESET 0281, ESET 0282, ESET 0283, ESET 0284, and ESET 0286. PREREQ: Prior AAS in an Energy System program or instructor approval. S, D

ESET 0286 Critical Network Security: 3 semester hours.
Comprehensive review and analysis of current and developing control and data system networks. Host-based and network-based intrusion detection, anomaly and misuse detection. Network security appliances, including firewalls and access control devices. Procurement and installation of network, hardware and software systems for mission critical enterprises. COREQ: ESET 0281, ESET 0282, ESET 0283, ESET 0284, and ESET 0285. PREREQ: Prior AAS in an Energy System program or instructor approval. S, D

ESET 0290 Energy Systems Theory I: 8 semester hours.
Theory in application of energy systems control devices, sensors, timers, relays, programmable controllers, electrical code, print reading, single phase, split phase, three phase and variable frequency motor control, and interfacing with devices used in automated electrical power generation facilities. COREQ: ESET 0290L. F, D

ESET 0290L Energy Systems Laboratory I: 5 semester hours.
Experiments in motor control circuits, relay and ladder logic circuits, computer interfacing with programmable controllers, transformers, timers, sensors, variable frequency controllers, thyristor circuits, troubleshooting electrical devices, and adapting relay logic circuits to programmable controllers. COREQ: ESET 0290. F, D

ESET 0291 Energy Systems Theory II: 8 semester hours.
Theory in the application of Energy Systems control devices that measure and control pressure, temperature, level, flow, humidity, PH, viscosity, velocity, volume, density, conductivity and composition; instruction in calibration and test procedures used to install, maintain, and troubleshoot components common to industrial facilities. COREQ: ESET 0291L. S, D

ESET 0291L Energy Systems Laboratory II: 4 semester hours.
Application of Energy Systems control devices including: calibration of transmitters, recorders, indicators, and controllers. Interfacing pneumatic, electrical, electronic, hydraulic, programmable controllers, and computer devices. PID control loop tuning, installation and troubleshooting of working systems. COREQ: ESET 0291. S, D

ESET 0292 Electrical Engineering Technology I: 7 semester hours.
Theory involving communication and various data and information transfer circuits, principles of motor controls, microcontroller and programmable logic controller (PLC) programming, and electrical machines including energy storage, transfer, and conversion applicable to electric motors, generators, and other electromechanical transducers. COREQ: ESET 0292L. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. F, D

ESET 0292L Electrical Engineering Technology I Laboratory: 5 semester hours.
Lab involving communication and various data and information transfer circuits, principles of motor control, microcontroller and programmable logic controllers (PLC) programming, and electrical machines including energy storage, transfer, and conversion applicable to electric motors, generators, and other electromechanical transducers. COREQ: ESET 0292. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. F, D

ESET 0293 Electrical Engineering Technology II: 5 semester hours.
Electrical power industry theory addressing generation, operations and distribution of power systems including electronic components, functions, and configurations of power, amplifiers, oscillators, thyristors, power control and regulation circuits, sensors, and networks. COREQ: ESET 0293L. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. S, D

ESET 0293L Electrical Engineering Technology II Laboratory: 4 semester hours.
Electric power generation lab, electric power distribution lab, and electric power industry lab industry lab addressing operations of power systems including electronic components, functions, and configurations of power, amplifiers, oscillators, thyristors, power control and regulation circuits, sensors and networks. COREQ: ESET 0293. PREREQ: ESET 0101, ESET 0101L, ESET 0102, ESET 0102L, ESET 0141, ESET 0142, or permission of instructor. S, D

ESET 0296 Independent Study: 1-8 semester hours.
Addresses specific learning needs of individuals for the enhancement of knowledge and skills within the program area under the guidance of an instructor. May be repeated. Graded S/U, or may be letter-graded. PREREQ: Permission of the instructor. F, S, D

ESET 0297 Internship: 1-8 semester hours.
On-the-job placement providing work experience for persons pursuing careers in electronics technology. PREREQ: Permission of instructor. D

ESET 0298 Special Topics: 1-8 semester hours.
Addresses the specific needs of industry, enabling students to upgrade technical skills that are not included in the current program curriculum. May be repeated. Graded S/U, or may be letter-graded. PREREQ: Permission of instructor. F, S, D
**Instr and Auto Engr Tech Courses**

**INST 0140 Introduction to Motors and Motor Control Theory: 2 semester hours.**
Introduces basic motors and motor control. Fundamentals of AC and DC motors; includes two-wire and three-wire controls using various controllers, control relays, timing relays, solenoid valves, latching relays, and motor control centers. Computer software used to design and verify motor control circuits. **S**

**INST 0220 Introduction to Programmable Logic Controllers: 3 semester hours.**
Ladder format, I-O instructions, external devices, operating cycle, relays, timers, counters, sequencers, shift registers, analog applications, math blocks, and troubleshooting. **F, S**

**INST 0236 Applications of Electronic Electrical and Industrial Process Control Fundamentals: 6 semester hours.**
Application of electronic sensors, thyristor circuits, and networks. Electrical motor control, relays, timers, and PLCs. Computer software used to design and verify motor control circuits, variable frequency drives, and interface methods for controllers. Basic process control, print reading, and device calibration methods. Troubleshooting techniques and safety practices. **D**

**INST 0240 Theory: 2 semester hours.**
Basic concepts of process control devices, calibration and test equipment, diagrams and symbols. **F, S, Su**

**INST 0242 Theory: 2 semester hours.**
Electronic instruments-sensors, indicators, transmitters, computing relays, electro-optics, electronic controllers, ratio control, cascade control, recorders, analytical equipment, troubleshooting. **F, S, Su**

**INST 0250 Laboratory: 1 semester hour.**
Use of test equipment, power supplies, current and volt measurements, use of oscilloscope, capacitor checker, decade box, Wheatstone bridge, transmitter simulator, manometers, pressure calibration devices. **F, S, Su**

**INST 0251 Laboratory: 1 semester hour.**
Set up, maintenance, and troubleshooting of pneumatic control systems, air supply, air regulators, pressure gauges pneumatic transducer calibration, control valve operation with and without positioner, controller operation set point, measurement error, offset, proportional band, reset, derivative, reverse and direct acting. **F, S, Su**

**INST 0253 Laboratory: 1 semester hour.**
Computer and programmable controller interfacing with transmitters and final elements, PID loops, auto tuning, set up to complete control loops, computer graphics. **F, S, Su**

**INST 0254 Laboratory: 1 semester hour.**
Calibration of transmitters, simulation of process variables, temperature, pressure, level flow, and humidity control loops. **F, S, Su**

**INST 0260 Electrical Systems Documentation and Standards: 2 semester hours.**
Introduction to print reading, technical specifications, print annotation, report writing and Electrical codes. **F, S, Su**

**INST 0281 Electrical Automation Theory: 8 semester hours.**
Theory of control devices and automated systems, sensors, timers, relays, solenoids, line starters, programmable logic controllers (PLCs), print reading, motor control, programming and configuring controllers, Human Machine Interfaces (HMIs), variable frequency drives (VFDs), basic Ethernet communication. **COREQ: INST 0282, F, S**

**INST 0282 Electrical Automation Laboratory: 5 semester hours.**
Application of INST 0281. Design, install, and troubleshoot automated control systems, relays, sensors, solenoids, indicators, timers, transformers, line starters, motors, programmable logic controllers (PLCs), variable frequency drives (VFDs), human machine interfaces (HMIs), basic Ethernet communication. **COREQ: INST 0281, F, S**

**INST 0288 Directed Studies: 1-8 semester hours.**
Study tailored to individual assignment and reporting under faculty guidance. Student will pursue a unit of activity related to the instrumentation/industrial controls field. May be repeated for a maximum of 16 credits. **PREREQ: Permission of instructor. F, S, Su**

**INST 0292 Process Measurement and Control Theory: 10 semester hours.**
Theory of pressure, temperature, level, flow, and analytical measurement. Methods of tuning and troubleshooting process control loops. Final element selection and troubleshooting. Fundamentals of thermodynamics and an overview of boiler, turbine, and reactor systems. **F, S**

**INST 0293 Process Measurement and Control Laboratory: 4 semester hours.**
Application of INST 0292; calibration of transmitters, indicators, and controllers. Interfacing pneumatic, electrical, electronic, and computer devices. PID control loop tuning, installation and troubleshooting of working systems. Connecting and configuring instrumentation for programmable controllers. Process control programming. **F, S**

**INST 0294 Cooperative Training: 1-16 semester hours.**
Student pursues on-the-job training in the instrumentation/industrial controls industry which satisfies competencies in lieu of instrumentation/industrial controls courses. A University Co-op agreement must be signed by all parties involved. Student will pursue a pre-determined unit of activity related to the field of study. May be repeated for a maximum of 16 credits. **PREREQ: Permission of instructor. D**

**INST 0298 Special Topics: 1-8 semester hours.**
Addresses the specific needs of industry, enabling students to upgrade technical skills that are not included in the current program curriculum. May be repeated. Graded S/U, or may be letter-graded. **PREREQ: Permission of instructor. D**