**ENGINEERING SCIENCE (ES)**

**College of Engineering and Mines**  
907-474-7730

**ES F100L  Makerspace Alaska - A Laboratory Introduction to Engineering**  
1 Credit  
Offered Fall and Spring  
Through hands-on projects, students will learn basic programming with a Raspberry Pi computer kit, basic computer-aided design for 3D printing and using a Laser Cutter. Students will develop leadership, team and communication skills needed to successfully complete project that utilize the engineering design and design thinking processes.  
**Prerequisites:** placement into MATH F105.  
**Special Notes:** In order to fulfill the GER Natural Sciences requirement, both ES F100X and ES F100L need to be completed; If only one course is completed, no credit is given to the GER Natural Sciences requirement.  
**Attributes:** UAF GER Natural Science Req  
**Lecture + Lab + Other:** 0 + 3 + 0  
**Grading System:** Letter Grades with option of Plus/Minus

**ES F100X  Engineering Alaska - An Introduction to Engineering**  
3 Credits  
Offered Fall and Spring  
Overview of the engineering profession and introduction to the field of engineering with a focus on engineering in the remote and extreme conditions of Alaska. Basic science, mathematics and engineering concepts are applied to problem solving. Communication skills including communicating engineering calculations, word processing and use of spreadsheets are taught.  
**Prerequisites:** placement into MATH F105.  
**Special Notes:** In order to fulfill the GER Natural Sciences requirement, both ES F100X and ES F100L need to be completed; If only one course is completed, no credit is given to the GER Natural Sciences requirement.  
**Attributes:** UAF GER Natural Science Req  
**Lecture + Lab + Other:** 3 + 0 + 0  
**Grading System:** Letter Grades with option of Plus/Minus

**ES F101  Introduction to Engineering**  
3 Credits  
Offered Fall and Spring  
Overview of the engineering profession and introduction to the fields of engineering. Basic concepts from engineering, physics and mathematics applied to engineering problem solving. Basic skills required of engineers, including an introduction to engineering communications; word processing, descriptive geometry, orthographic and isometric drawings, graphs, computer graphics and use of spreadsheets.  
**Prerequisites:** MATH F151X, MATH F152X, MATH F156X or placement into MATH F251X.  
**Lecture + Lab + Other:** 2 + 2 + 0  
**Grading System:** Letter Grades with option of Plus/Minus

**ES F208  Mechanics**  
4 Credits  
Offered Fall and Spring  
Engineering-oriented coverage of statics and dynamics. Vector methods used where appropriate.  
**Prerequisites:** MATH F252X (may be taken concurrently); PHYS F211X (may be taken concurrently); ES F101, GE F101, MIN F110, PETE F101.  
**Lecture + Lab + Other:** 3 + 3 + 0  
**Grading System:** Letter Grades with option of Plus/Minus

**ES F209  Statics**  
3 Credits  
Offered Fall  
Analyzes force systems in two and three dimensions; composing and resolving of forces and force systems; applies principles of equilibrium for various bodies and simple structures, friction, centroids and moments of inertia. Applies concept of vector algebra wherever necessary.  
**Prerequisites:** MATH F252X (may be taken concurrently); PHYS F211X (may be taken concurrently); PETE F101 or ES F100X.  
**Lecture + Lab + Other:** 3 + 0 + 0  
**Grading System:** Letter Grades with option of Plus/Minus

**ES F301  Engineering Analysis**  
3 Credits  
Offered Fall and Spring  
Application of numerical tools, including software, to typical engineering design problems. Selected topics from all fields of engineering.  
**Prerequisites:** MATH F302 (may be taken concurrently); ES F201.  
**Lecture + Lab + Other:** 3 + 0 + 0  
**Grading System:** Letter Grades with option of Plus/Minus

**ES F307  Elements of Electrical Engineering**  
3 Credits  
Offered Fall  
Elementary circuits and theorems, natural, forced and steady state response, principles of electronics, circuit models and system parameters, elements of measurement and instrumentation, characteristics of DC machines, and AC machines and transformers.  
**Prerequisites:** MATH F252X.  
**Lecture + Lab + Other:** 3 + 0 + 0  
**Grading System:** Letter Grades with option of Plus/Minus

**ES F331  Mechanics of Materials**  
3 Credits  
Offered Fall and Spring  
Analysis of internal forces in members subjected to axial, torsional and flexural loads, singly and in combination. Stress-strain relationships and material property definitions; shear and moment diagrams, Mohr’s Circle. Applications include beams, columns, connections and indeterminate cases.  
**Prerequisites:** ES F208 or ES F209; MATH F252X.  
**Lecture + Lab + Other:** 3 + 0 + 0  
**Grading System:** Letter Grades with option of Plus/Minus
ES F341  Fluid Mechanics
4 Credits
Offered Fall and Spring
Statics and dynamics of fluids; energy and momentum principles. Dimensional analysis; flow in open channels, closed conduits and around submerged bodies.
Prerequisites: ES F208 or ES F210; MATH F252X.
Lecture + Lab + Other: 3 + 3 + 0
Grading System: Letter Grades with option of Plus/Minus

ES F346  Introduction to Thermodynamics
3 Credits
Offered Fall and Spring
Fundamental principles and elementary applications of thermodynamics, including the first and second laws of thermodynamics, and thermodynamic systems, properties, processes and cycles.
Prerequisites: MATH F252X; PHYS F211X.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus