Engineering Science (ES)

Courses

ES A103 Engineering Graphics **3 Credits**
Introduces the fundamentals of engineering graphics and provides training in visualization skills necessary for graphically presenting of engineering ideas using standard drawing techniques and Computer Aided Design (CAD).
Prerequisites: MATH A152 with a minimum grade of C or MATH A155 with a minimum grade of C.

ES A106 Engineering Graphics **2 Credits**
Develops visualization skills, orthographic projections, creation of sectional views, auxiliary views, isometric pictorials, and adding necessary details such as dimensions and tolerances. Develops hand drawing skills and the use of computer-aided design (CAD) software as tools for creating engineering graphics.
Prerequisites: (MATH A151 with a minimum grade of C and MATH A152 with a minimum grade of C) or MATH A155 with a minimum grade of C or ALEKS Overall Test 1 with a score of 78 or ALEKS Overall Test 2 with a score of 78 or ALEKS Overall Test 3 with a score of 78 or ALEKS Overall Test 4 with a score of 78 or ALEKS Overall Test 5 with a score of 78.

ES A208 Engineering Statics and Dynamics **5 Credits**
Static and dynamic analysis of particles and rigid bodies. Statics topics covered include Newton's laws of motion, Newton's law of gravitational attraction, force and force systems, equilibrium, structural analysis, internal forces, friction, and center of gravity and centroid. Dynamics topics covered include particle and rigid body kinematics and kinetics, force and acceleration, work and energy, impulse and momentum, and vibrations.
Prerequisites: (MATH A252 with a minimum grade of C or MATH A252F with a minimum grade of C) and PHYS A211 with a minimum grade of C.

ES A209 Statics **3 Credits**
Introduces concepts of engineering mechanics with applications using calculus, graphical, scalar, and vector methods. Develops representation of forces and force systems in two and three dimensions for analysis of equilibrium of particles and rigid bodies with applications to structures such as trusses, frames, and machines. Introduces computation of internal forces and moments, and determination of centroids, centers of gravity, and moments of inertia. Includes analyses of static equilibrium problems with Coulomb friction, and introduces the principle of virtual work.
Prerequisites: (MATH A252 with a minimum grade of C or MATH A252F with a minimum grade of C) and PHYS A211 with a minimum grade of C.

ES A210 Dynamics **3 Credits**
Introduces kinematics and kinetics of particles and rigid body motion. Applies principles of work and energy, impulse and momentum to particles and rigid body motion. Applies concept of vector algebra wherever required.
Prerequisites: ES A209 with a minimum grade of C.

ES A261 Introduction to Engineering Computation **3 Credits**
Introduces computation methods and tools for engineering applications. Introduction to computer programming with MATLAB.
Prerequisites: MATH A221 with a minimum grade of C or MATH A251 with a minimum grade of C or MATH A251F with a minimum grade of C.

ES A302 Engineering Data Analysis **3 Credits**
Introduces concepts of probability and statistics needed to solve various engineering problems.
Prerequisites: (MATH A252 with a minimum grade of C or MATH A252F with a minimum grade of C) and (ES A261 with a minimum grade of C or EE A261 with a minimum grade of C).

ES A309 Elements of Electrical Engineering **3 Credits**
Electrical fundamentals: elementary circuit analysis, network theorems, steady state, and transient analysis of DC circuits with resistors and one energy storage device (L or C). Steady state analysis of AC circuits with resistors, capacitors, and inductors using complex number and phasor representation. Power in DC and AC circuits. Transformers, meters, and applications of simple electrical components and circuits.
Prerequisites: PHYS A212 with a minimum grade of D and MATH A302 with a minimum grade of D or concurrent enrollment.

ES A331 Mechanics of Materials **3 Credits**
Stress-strain relations, axially loaded and torsional members, review of shear and bending moment diagrams for beams, flexural and shearing stresses, deflections of beams, plane stress, combined stresses, buckling of columns, elementary design of beams and columns.
Prerequisites: ES A209 with a minimum grade of C and MATH A302 with a minimum grade of C or concurrent enrollment.

ES A341 Fluid Mechanics **3 Credits**
Introduces physical properties and behavior of fluids. Topics include hydrostatics and dynamics of liquids and gases, dimensional analysis, fluid forces on immersed bodies, pipe flow, fluid machinery, and open channel flow.
Prerequisites: ES A209 with a minimum grade of C and (ES A302 with a minimum grade of C or concurrent enrollment or STAT A307 with a minimum grade of C or concurrent enrollment) and MATH A302 with a minimum grade of C or concurrent enrollment.

ES A341L Fluid Mechanics Laboratory **1 Credit**
Provides supplemental explanation and practical exercises applying physical properties and behavior of fluids, including hydrostatics, fluid forces, pipe flow, fluid machinery, and open channel flow.
Prerequisites: ES A341 with a minimum grade of C or concurrent enrollment.

ES A346 Introduction to Thermodynamics **3 Credits**
Covers thermodynamic systems, properties, processes and cycles.
Introduces fundamental principles of thermodynamics (first and second
laws) and elementary applications.
Prerequisites: (MATH A252 with a minimum grade of C or
MATH A252F with a minimum grade of C) and PHYS A211 with a
minimum grade of C.

ES A411 Northern Design **3 Credits**
Introduction to design and maintenance of facilities in northern climates
to construct sustainable, energy-efficient and durable buildings and
infrastructure suitable for the unique needs of northern inhabitants.
Registration Restrictions: Senior standing or graduate standing in
an accredited program in architecture or engineering, or instructor
permission.

ES A666 Assessment and Communication of Engineering Research **1
Credit**
Discusses the structure, methods and assessment tools needed to
communicate basic and applied research at the graduate level in
engineering fields. The course is designed to guide the student through
the process of establishing, organizing, writing, and orally expressing
graduate level research conducive to a publication, thesis or proposal.
Special Note: Can be repeated once to further develop and enhance
research and communication skills.
Registration Restrictions: Graduate standing and admission to the
College of Engineering