**Engineering Science (ES)**

**Courses**

**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 MATH A211 with a minimum grade of C or MATH A212 with a minimum grade of C or 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 or MATH A252 with a minimum grade of C or MATH A252F with a minimum grade of C or MATH A253 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 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 A331 Mechanics of Materials** 3 Credits
Introduces the concepts of stress and strain. Relate stresses and strains by modeling material behavior. Analyze and design axially loaded members, torsional shafts, transversely loaded beams, thin-walled pressure vessels, and axially loaded columns, relating loads and displacements with stresses and strains. Analyze a general state of stress and strain, including the special cases of plane stress and plane strain.

**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 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