UNDERGRADUATE
MINOR IN

PENN STATE ENGINEERING

PENNSTATE

Engineering Mechanics

To Learn More, Contact:

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CAREER OPPORTUNITIES

Contemporary engineering design of mechanical components requires precise information and modern analysis techniques regarding material response to anticipated loads. Designers must have the analytical and experimental tools to precisely define deformation under load and to characterize dynamic response as well as prevent mechanical failure. In the event of failure the cause(s) must be ascertained with a view toward redesign and/or material substitution. Thus, high-tech industry has a real need for those with a sound background in engineering mechanics. Aerospace, automotive, power, structures, and appliance industries, for example, hire students competent in engineering mechanics.

PROGRAM REQUIREMENTS

Students must:

— Complete at least 18 credits in Penn State Engineering Mechanics courses.

— Take a minimum of 6 credits at the 400 level.

— Achieve a grade of C or better in each E MCH course counted toward the 18-credit minimum.

ADMISSION REQUIREMENTS

Applicants wishing to enroll in the Engineering Mechanics minor should have completed a background course in mathematics (MATH 250 or 251) and physics (PHYS 211), present an acceptable schedule for completion of requirements, and have a 2.50 grade-point average at the time of application.

Engineering mechanics is the engineering science that deals with the effects of forces and torques on particles, rigid bodies, or deformable media. Mechanics is typically subdivided into statics, dynamics, and mechanics of deformable bodies.

Statics considers the algebra of vectors, equilibrium, equivalency of force/torque systems, and the concept of the freebody diagram. Special topics include friction, machines, and trusses.

Dynamics treats the motion resulting from unequilibrated force/torque systems, through the study of acceleration, velocity, and displacement. An important special topic is simple harmonic motion, caused by a restoring force that is linearly dependent on displacement—this topic is the foundation of vibrations. Newton's laws and energy principles form the basis of dynamics.

Mechanics of Deformable Materials covers the internal distribution of force per unit area (stress), local normalized deformation (strain), and material response (strain, strain rate, and temperature) to stress. Failure criteria are introduced and used in design. Because the determination of the stress distribution in most engineering components is complex, special techniques, such as finite elements, are used. Subgroups of this general topic include:

— **Strength of Materials:** Stretching, bending, twisting of long, thin, elastic bodies, Hooke's law, yielding, and fracture.

— **Plates and Shells:** Two-dimensional elastic bodies.

— **Elasticity:** Stress/strain in three-dimensional elastic bodies.

— **Viscoelasticity:** Stress proportional to strain and strain rate.

— **Engineering Materials:** Characterization of material properties, deformation mechanisms, failure criteria.

— **Experimental Stress Analysis**

— **Nondestructive Evaluation (NDE)**

— **Failure Analysis and Prevention**

— **Composite Materials:** Engineering material systems whose properties are complex functions of the component materials.

The Department of Engineering Science and Mechanics offers more than twenty engineering mechanics courses at a level appropriate to an undergraduate minor.