

# PSU Berks Degree in Mechanical Engineering

Built upon a broad foundation in physics, chemistry, and mathematics, this major has the objective of educating graduates to be problem solvers. Graduates of this program will have had opportunities to learn about applying scientific principles, engineering analysis, and engineering design to solve unstructured problems that are typical of those found in mechanical engineering. The major helps prepare graduates for a lifelong productive career, whether they choose professional practice, graduate school, or some other career path. Graduates will have had opportunities to learn how to work with others toward a common goal, to clearly express their ideas in written and verbal form, and to be independent and capable of adapting to the continuously changing technology of the work environment.

After completing the fundamental science core, students may pursue their interest in mechanical engineering by studying fluid and solid mechanics, engineering materials and their properties, thermodynamics and heat transfer, computer-aided design, kinematics and dynamics of machine elements, machine design, finite elements, control systems, electricity, and electronic instrumentation and machinery. The students will be required to analyze and solve a significant mechanical engineering design problem during their senior year as part of the yearlong capstone design experience.

## **Freshman Classes (First Semester) 17 credits**

- EDSGN 100: Introduction to Engineering Design (3) Introduction to engineering design processes, methods, and decision making using team design projects; design communication methods including graphical, verbal, and written.
- CHEM 110: Chemical Principles I (3) Basic concepts and quantitative relations. Prerequisite: satisfactory performance on the Chemistry and Math FTCAP tests - i.e. placement beyond the level of CHEM 101 and MATH 022; or CHEM 101 and MATH 022 or MATH 041
- MATH 140: Calculus With Analytic Geometry I (4) Functions, limits; analytic geometry; derivatives, differentials, applications; integrals, applications. Prerequisite: MATH 022, MATH 026 ; or MATH 040 or MATH 041 or satisfactory performance on the mathematics FTCAP examination
- ENGL 015 OR 030 (3)(GWS):
- Arts (GA), Humanities (GH), or Social & Behavioral Sciences (GS) (3)
- First Year Seminar (1)

## **Freshman Classes (Second Semester) 18 credits**

- CMPSC 200: Programming for Engineers with MATLAB (3) Development and implementation of algorithms in a procedure-oriented language, with emphasis on numerical methods for engineering problems. Prerequisite: MATH 140. Concurrent: MATH 141
- MATH 141: Calculus with Analytic Geometry II (4) Derivatives, integrals, applications; sequences and series; analytic geometry; polar coordinates. Prerequisite: MATH 140.
- MATH 220: Matrices (2) Systems of linear equations; matrix algebra; eigenvalues and eigenvectors; linear systems of differential equations. Prerequisite: MATH 140

- PHYS 211: General Physics: Mechanics (4) Calculus-based study of the basic concepts of mechanics: motion, force, Newton's laws, energy, collisions, and rotation. Concurrent: MATH 140
- CHEM 111: Experimental Chemistry I (1) Introduction to quantitative experimentation in chemistry. Prerequisite: or concurrent: CHEM 110 or CHEM 106
- CAS 100 (GWS)(3): Effective Speech

### **Sophomore Classes (First Semester) 16.5 credits**

- EMCH 211: Statics (3) Equilibrium of coplanar force systems; analysis of frames and trusses; non-coplanar force systems; friction; centroids and moments of inertia. Prerequisite: or concurrent: MATH 141.
- MATH 230: Calculus and Vector Analysis (4) Three-dimensional analytic geometry; vectors in space; partial differentiation; double and triple integrals; integral vector calculus. Prerequisite: MATH 141.
- MATH 251: Ordinary and Partial Differential Equations (4) First- and second-order equations; special functions; Laplace transform solutions; higher order equations; Fourier series; partial differential equations. Prerequisite: MATH 141.
- PHYS 212: General Physics: Electricity and Magnetism (4) Calculus-based study of the basic concepts of electricity and magnetism. Prerequisite: MATH 140, PHYS 211 Concurrent: MATH 141
- Health and Physical Activity (GHA) (1.5)

### **Sophomore Classes (Second Semester) 17 credits**

- EE 211: Electrical Circuits and Power Distribution (3) D.C. and A.C. circuits, transformers, single and three-phase distribution systems, A.C. motors and generators. Prerequisite: PHYS 212.
- EMCH 212: Dynamics (3) Motion of a particle; relative motion; kinetics of translation, rotation, and plane motion; work-energy; impulse-momentum. Prerequisite: EMCH 211 or EMCH 210; MATH 141
- EMCH 213 OR EMCH 213D: Strength of Materials with Design (3) Stress and deformation in members under axial, bending, and torsional loads, combined stress; columns. Prerequisite: EMCH 211, ED&G 100
- ME 300: Engineering Thermodynamics I (3) Basic thermodynamics concepts, properties of pure substances, first and second law analysis of systems and control volumes. Prerequisite: CHEM 110, MATH 141
- PHYS 214: General Physics: Wave Motion and Quantum Physics (2) Calculus-based study of the basic concepts of wave motion, geometrical optics, interference phenomena, photons, wave mechanics, and the structure of matter. Prerequisite: MATH 141, PHYS 211 and PHYS 212
- ENGL 202C (GWS)(3): Effective Writing: Technical Writing

### **Junior Classes (First Semester) 17 credits**

- MATSE 259: Properties and Processing of Engineering Materials (3) Relationship of structure and processing variables to the properties and service behavior of metals, polymers, and ceramics. Prerequisite: EMCH 213 or EMCH 210
- ME 320: Fluid Flow (3) Thermodynamic and dynamic principles applied to fluid behavior; ideal, viscous, and compressible fluids under internal and external flow conditions. Prerequisite: EMCH 212, MATH 251; ME 201 or ME 300; MATH 230 or MATH 231
- ME 345W: Instrumentation, Measurements, and Statistics (4) Measurement concepts, probability and statistics, error analysis; electro- mechanical transducers, applied electrical and mechanical measurements, electrical and electronics instruments, data acquisition and instrumentation systems. Prerequisite: or concurrent: EE 212 or EE 211 or equivalent
- ME 349: Intermediate Mechanics of Materials (3) Intermediate topics in mechanics of materials with computer applications. Prerequisite: EMCH 213, EDSGN 100S Prerequisite or concurrent: CMPSC 200, MATH 220
- ME 365: Materials Testing Laboratory (1) Laboratory for materials testing, property identification and modification, failure analysis, and metallurgical testing. Prerequisite or concurrent: MATSE 259
- ECON 102 OR 104 (GS)(3): Intro. Micro-Macroeconomics Analysis and Policy

### **Junior Classes (Second Semester) 15 credits**

- ME 357: System Dynamics (3) Mathematical modeling and analysis of linear dynamic systems; performance and design of simple controllers. Prerequisite: CMPSC 200, EE 211 or EE 212, MATH 251
- ME 367: Machine Design (3) Design and selection of machine components and connections. Stress analysis and modes of failure of materials used in machine components. Prerequisite: ME 349 Prerequisite or concurrent: MATSE 259.
- ME 380: Machine Dynamics (3) Kinematic analysis of mechanisms such as linkages, flywheels, cams and gears. Dynamic forces and vibrations of mechanisms. Prerequisite: EMCH 212, MATH 251
- ME 410: Heat Transfer (3) Thermal energy transfer mechanisms: conduction (steady, transient), convection (internal, external), radiation; lumped parameter method; heat exchangers; introduction to numerical methods. Prerequisite: ME 320; CMPSC 200 or CMPSC 202; MATH 220; MATH 251
- Arts (GA), Humanities (GH), or Social & Behavioral Sciences (GS) (3)

### **Senior Classes (First Semester) 16 credits**

- ME 448: Engineering Design Concepts (3) Engineering design and modeling, engineering economic analysis techniques, technical communication skills, project planning and design. Prerequisite: M E 380 seventh-semester standing. Prerequisite or concurrent: ME 367, ME 410. Concurrent: ME 367, ME 410
- ME 468: Engineering for Manufacturing (3) Manufacturability, the selection of the most effective materials and processes, and quality assurance. Prerequisite: MATSE 259

- Lab Electives (300-400 Level)(1): ME 355 Dynamic Systems Laboratory (1) Experimental investigations of simple position, velocity, and temperature control systems with analog and digital controllers. Prerequisite: ME 345 ; Prerequisite or concurrent: ME 450
- Technical Electives (300-400 Level)(3): ME 370 Vibration of Mechanical Systems (3) Modeling and analysis of vibration characteristics of mechanical systems with single degree and multiple degrees of freedom. Vibration control by isolation, absorption and balancing. Prerequisite: EMCH 212, CMPSC 200, MATH 220, MATH 251
- Technical Electives (300-400 Level)(4): ME 445 Microcomputer Interfacing for Mechanical Engineers (4) Interfacing of electro-mechanical systems to microcomputers for data acquisition, data analysis and digital control. Prerequisite: ME 345 and seventh-semester standing
- Arts (GA), Humanities (GH), or Social & Behavioral Sciences (GS) (3)

**Senior Classes (Second Semester) 16.5 credits**

- ME 449: Mechanical Design Projects (3) Group or individual design projects in the areas of mechanical engineering. Prerequisite: ME 448, eighth-semester standing
- Technical Electives (300-400 Level)(3): ME 491 Bioengineering Applications of Mechanical Engineering (3) Application of mechanical engineering knowledge in the context of life sciences. Prerequisite: EE 211, ME 320, ME 357, EMCH 213, ME 349
- Technical Electives (300-400 Level)(3): ME 427 Incompressible Aerodynamics (3) Analysis of lift and drag using potential flow theory, effects of viscosity on potential flow calculations, wind tunnel testing. Prerequisite: ME 320
- Arts (GA), Humanities (GH), or Social & Behavioral Sciences (GS) (3)
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- Health and Physical Activity(1.5)