

engineering

minor

Program Description

Non-majors in Engineering may elect to minor in this field. Minor requirements may be satisfied by completing 18 approved units, of which 12 must be upper division. Students who have not completed the lower division requirements in calculus, including differential equations, physics, chemistry, and a few engineering courses will find it difficult to complete this minor in the four-year program due to the prerequisite requirements of upper division engineering courses.

Students wishing to minor in engineering must have their minor program approved by the Dean of the College of Engineering and Computer Science.

Requirements • Minor

Total units required for Minor: 18

Courses in parentheses are prerequisites.

The program should normally include:

- (3) ENGR 017 Introductory Circuit Analysis (PHYS 011C, MATH 045; either the math or physics may be taken concurrently, but not both)
- (3) ENGR 030 Analytic Mechanics: Statics (PHYS 011A, MATH 031, ENGR 004 or ENGR 006)
- (3) ENGR 045 Engineering Materials (PHYS 011A, CHEM 001A)
- (3) ENGR 110 Analytic Mechanics - Dynamics (ENGR 030, MATH 032, MATH 045)
- (3) ENGR 112 Mechanics of Materials (ENGR 030, ENGR 045, MATH 045)
- (3) ENGR 124 Thermodynamics (MATH 032, PHYS 011A, CHEM 001A)
- (3) ENGR 132 Fluid Mechanics (ENGR 110)

Faculty

Faculty will be drawn from the College of Engineering and Computer Science.

Contact Information

Mary Jane Lee, *Associate Dean* • Denise Anderson, *Administrative Support Coordinator* • Riverside Hall 2014 • (916) 278-6366 • www.ecs.csus.edu

Lower Division Courses

ENGR 001. Introduction to Engineering. Provide problem-solving skills needed in all areas of engineering offered at Sacramento State. Students will be exposed to different areas of engineering and will understand the relationship between them. Statics and dynamics, materials testing, surveying, fluid mechanics, analog circuits and digital circuits, and robotics will be introduced. Computers will be used throughout. Laboratory three hours. **Note:** Not for degree credit. **Prerequisite:** Algebra and Trigonometry, or instructor permission. Graded Credit/No Credit. 1 unit.

ENGR 004. Engineering Graphics and CAD. In-depth graphic analysis and solution of typical three dimensional space problems by applying the principles of orthogonal projection. Fundamentals of interactive computer aided design and drafting. Laboratory six hours. 2 units.

ENGR 006. Engineering Graphics and CADD (Computer Aided Drafting and Design). In-depth graphical analysis and solution of typical three-dimensional space problems by applying the principles of orthogonal projection. Fundamentals of interactive computer aided design and drafting. Preparation of engineering drawings utilizing the CAD system. Lecture two hours; laboratory three hours. 3 units.

ENGR 007. 3-D CAD Solid Modeling. Applications of three-dimensional representation techniques as used in a typical CAD (computer aided drafting) software package (AutoCAD). Fundamentals employed in creating, modifying, analyzing and filing engineering drawings. This course will have a mechanical emphasis. Lecture two hours; laboratory three hours. **Prerequisite:** ENGR 004 or ENGR 006. 3 units.

ENGR 017. Introductory Circuit Analysis. Writing of mesh and node equations. DC and transient circuit analysis by linear differential equation techniques. Application of laws and theorems of Kirchoff, Ohm, Thevenin, Norton and maximum power transfer. Sinusoidal analysis using phasors, average power. **Prerequisite:** PHYS 011C, MATH 045; either the math or physics may be taken concurrently, but not both. 3 units.

ENGR 017W. Circuits Workshop. Elaborates on fundamentals and enhances students' understanding of circuits. **Note:** Not for degree credit. **Corequisite:** ENGR 017. Graded Credit/No Credit. 1 unit.

ENGR 030. Analytic Mechanics: Statics. Statics of particles. Equivalent systems of forces. Equilibrium of rigid bodies. Centroids, centers of gravity and forces on submerged surfaces. Analyzes trusses including use of computer programs. Analyzes frames and machines. Forces in beams including shear and moment diagrams. Friction. Moments of inertia. **Prerequisite:** PHYS 011A, MATH 031, ENGR 004 or ENGR 006. 3 units.

ENGR 030W. Statics Workshop. Problem solving and discussion of topics in statics to enhance students' understanding of subject matter. Activity two hours. **Corequisite:** ENGR 030. Graded Credit/No Credit. 1 unit.

ENGR 045. Engineering Materials. Basic principles of mechanical, electrical and chemical behavior of metals, polymers and ceramics in engineering applications; topics include bonding, crystalline structure and imperfections, phase diagrams, corrosion, and electrical properties. Laboratory experiments demonstrate actual behavior of

materials; topics include metallography, mechanical properties of metals and heat treatment. Lecture two hours; laboratory three hours. **Prerequisite:** PHYS 011A, CHEM 001A; CHEM 001A may be taken concurrently. 3 units.

ENGR 060. MEP Orientation and Problem Solving. Mandatory class for MEP freshman students on orientation to the University, its resources, facilities and faculty. Students will be encouraged to form a group atmosphere where they can freely interact with each other and value each other as resources. Students will be provided with instruction and materials on study skills, note taking, time management, preparing for tests and dealing with stress. Presentation by working engineers and field trips to engineering firms will be taken. Personal and professional development will also be part of the freshman orientations with leadership, public speaking and career planning being topics of discussion. Lecture one hour; activity two hours. **Note:** Not for use as an engineering major technical elective and is not applicable to the baccalaureate degree. Graded Credit/No Credit. 2 units.

ENGR 070. Engineering Mechanics. Statics of particles. Equivalent systems of forces. Equilibrium of rigid bodies. Centroids, centers of mass and gravity. Analyzes trusses, frames and machines. Friction. Moments of inertia. Fundamental principles of kinematics and kinetics, study of motion and force analysis of particles and rigid bodies. **Prerequisite:** PHYS 011A. 3 units.

ENGR 096. Experimental Offerings in Engineering. When a sufficient number of qualified students are interested, one of the staff will conduct a seminar on some topic of engineering. **Note:** May be repeated for credit with permission of advisor. 1-4 units.

Upper Division Courses

ENGR 110. Analytic Mechanics - Dynamics. Fundamental principles of kinematics and kinetics, study of motion and force analysis of particles and rigid bodies, application to idealized structures and physical systems, introduction to free and forced vibrations. **Prerequisite:** ENGR 030, MATH 032, MATH 045. 3 units.

ENGR 112. Mechanics of Materials. Stresses, strains and deformations in elastic behavior of axial force, torsion and bending members, and design applications. Statically indeterminate problems. Strain energy. Column stability. **Prerequisite:** ENGR 030, ENGR 045, MATH 045. 3 units.

ENGR 115. Statistics for Engineers. Application of statistical methods to the analysis of engineering and physical systems. Data collection, characteristics of distributions, probability, uses of normal distribution, regression analysis, and decision-making under uncertainty. **Prerequisite:** MATH 031, may be taken concurrently. 2 units.

ENGR 117W. Networks Workshop. Elaborates on fundamentals and enhances students' understanding of networks. **Note:** Not for degree credit. **Corequisite:** EEE 117. Graded Credit/No Credit. 1 unit.

ENGR 120. Probability and Random Signals. Probability and random signals and their application in engineering systems. Topics include the random sample space model, concept of axiomatic probability, conditional probability, discrete and continuous random variables, probability density and distribution functions, functions and statistics of random variables, random vectors multivariate distributions, and correlation and covariance of random vectors. Applications include estimation, risk, signal detection, random signals and noise in linear systems, reliability, and estimation. **Prerequisite:** EEE 180; may be taken concurrently. 3 units.

ENGR 124. Thermodynamics. Study of thermodynamic principles and their applications to engineering problems. Includes a study of the first and second laws, the properties of pure substances and ideal gas, gas/vapor mixtures, and an introduction to thermodynamic cycles. **Prerequisite:** MATH 032, PHYS 011A, CHEM 001A. 3 units.

ENGR 132. Fluid Mechanics. Lectures and problems in the fundamental principles of incompressible and compressible fluid flow. **Prerequisite:** ENGR 110. 3 units.

ENGR 140. Engineering Economics. Evaluation of economic consequences of engineering design proposals on projects. Emphasis on marginal or incremental economic analysis using Net Present Value, Annual Equivalence, Rate of Return and Benefit-Cost methods including multiple alternatives, taxes, uncertainty, inflation, organizational constraints and money market factors. **Prerequisite:** ENGR 017, ENGR 030, or MET 030, or instructor permission. 3 units.

ENGR 181. Electronic Materials. Basic principles of materials behavior pertaining to electronics applications. Topics include electrical conductivity, bonding, crystal structures, optical properties, magnetic properties, energy transfer, and the fundamentals of some simple electronic devices. Lecture 3 hours. **Prerequisite:** CHEM 001A, PHYS 011A, MATH 045. 3 units.

ENGR 194. Career Development in Engineering and Engineering Technology. Designed for engineering and engineering technology students making career decisions. Instruction will include effective career planning strategies and techniques including skill assessments, interest, values, employment search strategy, goal setting, time management, interview techniques, and resume writing. Lecture one hour. **Prerequisite:** Senior status. Graded Credit/No Credit. 1 unit.

ENGR 196. Experimental Offerings in Engineering. When a sufficient number of qualified students apply, one of the staff will conduct a seminar in some topic of engineering. **Note:** May be repeated for credit with permission of advisor. 3 units.

ENGR 198. Co-Curricular Activities in Engineering and Computer Science. Designed for Engineering and Computer Science majors. Activities which expand and enhance a student's educational experiences including tutoring, peer advising, mentoring, leadership roles in engineering and computer science student organizations, and other activities related to the subject matter and concerns of the major and program. **Note:** May be repeated for credit. **Prerequisite:** Instructor permission. Graded Credit/No Credit. 1-3 units.

Graduate Courses

ENGR 201. Engineering Analysis I. Mathematical methods for the solution of advanced engineering problems. Vector analysis, tensors and matrix algebra, complex variable techniques. The applications of these methods to practical engineering problems are demonstrated. **Prerequisite:** MATH 45. Spring only. 3 units.

ENGR 202. Engineering Analysis II. Mathematical methods for the solution of advanced engineering problems. Solutions of ordinary and partial differential equations, Fourier series and Laplace transforms and operational calculus. The applications of these methods to practical engineering problems are demonstrated. **Prerequisite:** MATH 45. Fall only. 3 units.

ENGR 203. Engineering Statistics. Applications of statistics to engineering problems. Collection and analysis of data, sampling methods, design of experiments, probability theory, decision theory, analysis of variance, regression analysis, and mathematical curve fitting. **Prerequisite:** ENGR 115 or equivalent. 3 units.

ENGR 296. Experimental Offerings in Engineering. When a sufficient number of qualified students are interested, one of the staff will conduct a seminar in some advanced topic in engineering. **Note:** May be repeated for credit with permission of advisor. 1-4 units.