# REQUIREMENTS FOR THE BACHELOR OF SCIENCE IN ARCHITECTURAL ENGINEERING/MASTER OF SCIENCE

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## COLLEGE OF ENGINEERING

THE UNIVERSITY OF OKLAHOMA

For Students Entering the Oklahoma State System for Higher Education
**Summer 2009 through Spring 2010**

**GENERAL REQUIREMENTS**

Total Credit Hours . . . . . **150-154•**

**Minimum Retention/Graduation Grade Point Averages:**

Overall - Combined and OU . . . . . **3.00**

Major - Combined and OU . . . . . **3.00**

Curriculum - Combined and OU . . . . . **3.00**

**A minimum grade of C is required for each course in the curriculum.**

Architectural Engineering/Civil Engineering
**F035**
Bachelor of Science in Architectural Engineering/ Master of Science

**OU encourages students to complete at least 30-32 hours of applicable coursework each year to have the opportunity to graduate in five years.**

| Year | FIRST SEMESTER | Hours | SECOND SEMESTER | Hours |
|---|---|---|---|---|
| FRESHMAN | **ENGL 1113**, Prin. of English Composition (Core I) | 3 | **ENGL 1213**, Prin. of English Composition (Core I), **or** | 3 |
| | **CHEM 1315**, General Chemistry (Core II) | 5 | **EXPO 1213**, Expository Writing (Core I) | |
| | **MATH 1823**, Calculus & Analytic Geometry I (Core I) | 3 | | |
| | **ENGR 1410**, Freshman Engineering Orientation | 0 | **MATH 2423**, Calculus & Analytic Geometry II (Core I) | 3 |
| | **ARCH 1154,** Design and Graphics Studio I | 4 | **PHYS 2514**, General Physics for Engineering & Science Majors (Core II) | 4 |
| | ***CEES 1112,** Intro. to CEES | 2 | **ARCH 1254**, Design and Graphics Studio II | 4 |
| | | | **P SC 1113**, American Federal Government (Core III) | 3 |
| | **TOTAL CREDIT HOURS** | **17** | **TOTAL CREDIT HOURS** | **17** |
| SOPHOMORE | **ARCH 2243,** History of the Built Environment I (Core IV: Western Civilization & Culture) | 3 | **MATH 2443**, Calculus & Analytic Geometry IV | 3 |
| | | | **MATH 3113**, Intro. to Ordinary Differential Equations | 3 |
| | **HIST 1483**, U.S., 1492-1865, or **1493**, U.S., 1865-Present (Core IV) | 3 | **§CEES 1000**, CEES Seminar | 0 |
| | | | **CEES 2153**, Mechanics of Materials | 3 |
| | **MATH 2433**, Calculus & Analytic Geometry III | 3 | **CEES 2223**, Fluid Mechanics | 3 |
| | **PHYS 2524**, General Physics for Engineering & Science Majors | 4 | **GEOL 1114**, Physical Geology for Sci. & Engr., **or** other MATH or Basic Science Elective (four credit hrs.) | 4 |
| | **§CEES 1000**, CEES Seminar | 0 | | |
| | **CEES 2113**, Statics and Dynamics | 3 | | |
| | **TOTAL CREDIT HOURS** | **16** | **TOTAL CREDIT HOURS** | **16** |
| JUNIOR | **AME 2213**, Thermodynamics | 3 | **AME 3173**, Heat Transfer | 3 |
| | **§CEES 1000**, CEES Seminar | 0 | **§CEES 1000**, CEES Seminar | 0 |
| | **CEES 3253**, Introduction to Continuum Mechanics | 3 | **CEES 3334**, Measurements in CEES | 4 |
| | **CEES 3364**, Soil Mechanics | 4 | **CEES 3403**, Materials | 3 |
| | **CEES 3414**, Structural Analysis I | 4 | **CEES 3774**, Structural Design — Concrete and Steel | 4 |
| | **ENGR 2431**, Electrical Circuits | 1 | **ENGL 3153**, Technical Writing | 3 |
| | **ENGR 3401**, Engineering Economics | 1 | | |
| | **TOTAL CREDIT HOURS** | **16** | **TOTAL CREDIT HOURS** | **17** |
| | **✯ Admission to the accelerated program is by application and requires a minimum GPA of 3.20.** | | | |
| SENIOR | **AME 3363**, Design of Thermal-Fluid Systems | 3 | **ANTH 4623**, Approaches to Cross-Cultural Human Problems or approved substitute (Core IV, Non-Western Civ.) | 3 |
| | **§CEES 1000**, CEES Seminar | 0 | | |
| | **CEES 4113**, Building Lighting & Electrical Systems | 3 | **§CEES 1000**, CEES Seminar | 0 |
| | **CEES 4753**, Structural Design — Wood | 3 | **CEES 4333**, Foundation Engineering | 3 |
| | **CEES 4803**, Professional Practice | 3 | **CEES 4993**, Design of Building Systems | 3 |
| | ‡Professional Elective | 3 | †Approved Elective: Core III: Social Science | 3 |
| | | | †Approved Elective: Artistic Forms (Core IV) | 3 |
| | **TOTAL CREDIT HOURS** | **15** | **TOTAL CREDIT HOURS** | **15** |
| | **Students are eligible for graduate status upon graduation with the Bachelor of Science in Architectural Engineering.** | | | |
| FIFTH YEAR | **CEES 5021**, Technical Communications | 1 | **✣CEES 5020,** Special Topics | 2 |
| | ***CEES 5980,** Thesis Research**, or** Graduate-level Elective | 2-3 | ***CEES 5980,** Thesis Research **or** Graduate-level Elective | 2-3 |
| | **CEES** Graduate-level Elective | 3 | **CEES** Graduate-level Elective | 3 |
| | **CEES** Graduate-level Elective | 3 | **CEES** Graduate-level Elective | 3 |
| | **CEES** Graduate-level Elective | 3 | **CEES** Graduate-level Elective | 3 |
| | **TOTAL CREDIT HOURS** | **12-13** | **TOTAL CREDIT HOURS** | **11-14** |

✯ **Students may enter the accelerated program based on the undergraduate degree pattern offered in the year they first enrolled in the Oklahoma State System of Higher Education or later.**

✣ **Non-thesis students only.** Students pursuing the thesis option do not take CEES 5020, Special Topics.

✻ Dependent upon whether a student chooses the thesis or non-thesis option. Non-thesis option additionally requires: **CEES Graduate-level Elective** (6 hrs.) and **CEES 5020 Special Topics** (2 hrs.), and **Comprehensive Exam** to be taken in the last semester of study.

**NOTE:** Engineering transfer students may take ENGR 3410 in place of ENGR 1410.

Courses designated as Core I, II, III, IV, or Capstone are part of the General Education curriculum. Students must complete a minimum of 40 hours of General Education courses, chosen from the approved list.

†To be chosen from the **University-Wide General Education Approved Course List**. Three of these 12 hours must be upper-division (3000-4000). See list in the Class Schedule.

In the College of Engineering, in order to progress in your curriculum, and as a specific graduation requirement, a grade of C or better is required in each course in the curriculum. Please refer to the General Catalog for additional enrollment limitations.

Students must successfully complete prerequisite courses (with a minimum C grade) before proceeding to the next course.

•Two college-level courses in a single foreign language are required; this may be satisfied by successful completion of 2 years in a single foreign language in high school. Students who must take foreign language at the University will have an additional 6-10 hours of coursework.

‡ Chosen with approval of the faculty adviser.

§Students must complete a minimum of four semesters of CEES 1000.

*This course fulfills the Computer Literacy Requirement for graduation as required by the Oklahoma State Regents for Higher Education.

Fourth- and fifth-year graduate courses must satisfy approved Civil Engineering requirements for the Master of Science.

## COURSES IN ANTHROPOLOGY (ANTH)

**4623 Approaches to Cross-Cultural Human Problems.** Prerequisite: 1113 or junior standing. Introduces students to the complex problems of contemporary global-scale cultures and helps them better understand their place on this global arena. This course will look at specific international issues or problems, and relate them to processes occurring in many parts of the world. (Irreg.) [IV-NW]

## COURSES IN ARCHITECTURE (ARCH)

**1154 Design and Graphics Studio I (Crosslisted with Interior Design 1154).** Individual and/or team projects at an introductory level focused on the comprehensive integration of social, cultural, theoretical, environmental, and technical influences. Application of professional techniques of representation and communication required. (F)

**1254 Design and Graphics Studio II (Crosslisted with Interior Design 1254).** Prerequisite: 1154 witha grade of C or better. Students are introduced to the basic principles and concepts for design professionals. Topics include cultural, social, theoretical and behavioral factors and their implications for planning and designing the built environment. Application of professional techniques of representation and communication are required. (Sp)

**2243 History of the Built Environment I.** Prerequisite: majors only or permission of instructor. A theological investigation of the cultural, historical, political and aesthetic values of diverse Western and non-western cultures that result in significant built environments through the 16th century. Buildings, urbanism, theories, and cultural context will be emphasized. (F) [IV-WC]

## COURSES IN CIVIL ENGINEERING AND ENVIRONMENTAL SCIENCE (CEES)

**1000 CEES Seminar.** Seminar provides a common meeting time for students and faculty for department activities, such as invited speakers, project presentations, educational surveys, cross-course project coordination, and policy announcements. Students must enroll every semester that they are matriculated in CEES at OU after the freshman year, but in no case can a student graduate without successfully completing four semesters of seminar. (F, Sp)

**1112 Introduction to Civil Engineering and Environmental Science.** Introduction to fundamental concepts (mass/flow balance), problem solving and design, and simple computing software for architectural, civil or environmental engineers and environmental scientists. (F)

**2113 Statics and Dynamics (Crosslisted with Petroleum Engineering 2113).** Prerequisites: Physics 2514 and Mathematics 2433 or concurrent enrollment in Mathematics 2433. Vector representations of forces and moments; general three-dimensional theorems of statics and dynamics; centoids and moments of area and inertia. Free-body diagrams, equilibrium of a particle and of rigid bodies, principles of work and energy; principle of impulse-momentum. Motion of particles and rigid bodies in translating and rotating reference frames. Newton's law of motion and Lagrange's equation, including application to lumped-parameter systems. Analyses of trusses, frames and machines. (F, Sp)

**2153 Mechanics of Materials.** Prerequisites: 2113. Basic principles of mechanics, including the definition of stress and strain, transformations and principal values for the stress and strain tensors, kinematic relations, review of conservation equations and the development and application of constitutive laws for idealized materials. Elementary elastostatics utilizing Hooke's law; constitutive relations for a linear-elastic continuum, including elastic parameters such as Young's modulus, shear and bulk moduli and Poisson's ratio. Solution of elementary one- and two-dimensional mechanics problems, including thermal stresses and strains, beam flexure, shear and deflections, pressure vessels and buckling of columns. (Sp)

**2223 Fluid Mechanics.** Prerequisites: 2113, Mathematics 3113 or concurrent enrollment. Coverage of the fundamentals of fluid statics and dynamics. Formulation of the equation of fluid flow, i.e., Navier-Stokes equations, Eulers equations, Bernoulli equations, etc. and their application. Examples of ideal fluid flow and viscous fluid flow, such as flow in open and closed conduits. (Sp)

**3253 Introduction to Continuum Mechanics.** Prerequisite: 2153 and Mathematics 3113. Mechanics of a deformable continuum, including applications of plane stress, plane strain and an introduction to three-dimensional elastostatics. Thermodynamics of deformable media, including energy formulations suitable for closed-form applications and for computational approximations. Constitutive relations for engineering materials, including nonlinear stress-strain relations and multiphysics problems with coupling of the behavior of solids and fluids within the framework of poromechanics. Considerations for structural mechanics, micromechanics and nanomechanics. (F)

**3334 Measurements in CEES.** Prerequisites: Mathematics 2423, Physics 2424 or Physics 2524. Introduction to measurement (laboratory and field) techniques, data analysis and interpretation and applications to architectural, civil or environmental engineering and environmental science problems. Topics include statistics, land surveying, remote sensing, GIS, environmental sampling and analysis and sensors. **Laboratory** (Sp)

**3364 Soil Mechanics.** Prerequisite: 2153. General treatment of the physical and mechanical properties of soils. Theories of effective stress, consolidation, lateral earth pressure, bearing capacity, slope stability and groundwater flow. **Laboratory** (F)

**3403 Materials.** Prerequisite: 2153 or concurrent enrollment. Study of the properties of materials utilized by architectural and civil engineers; analyses of aggregates, concrete, masonry, steel, asphalt, plastics and wood. **Laboratory** (Sp)

**3414 Structural Analysis I.** Prerequisite: 2153. Loads, reactions and force systems; introduction to design codes; analysis of frames and trusses; calculation of structural deformations; and analysis of indeterminate structures. Emphasis on classical solutions and time-tested approaches to structural engineering. Introduction to structural analysis computer programs to solve complex problems. (F)

**3774 Structural Design – Concrete and Steel.** Prerequisite: 3403 and 3414. Design of structural members constructed of reinforced concrete and/or steel. Concrete design will include beams in flexure/shear, one way slabs, development length, serviceability and an introduction to columns. Steel design will include tension elements, columns, beams, beam columns and an introduction to connections. **Laboratory** (Sp)

**4113 Building Lighting and Electrical Systems.** Prerequisite: Mathematics, 2423, Physics 2524, Engineering 2431 or equivalents. Fundamentals of building lighting and electrical systems. Lighting topics include the determination of appropriate lighting quantity and quality, luminaires and lighting design procedures for residentoal, commercial and industrial buildings. Electircal topics will include service voltages, overcurrent protection, short circuit analysis and branch circuit design for residential, commercial and industrial buildings. (F)

**G4333 Foundation Engineering.** Prerequisiste: 3364. Substructure analysis and design to meet various soil conditions; footings and rafts, shoring and underpinning, piles, cofferdams, caissons, breakwaters, piers, wharves, vibratory effects on foundations. (Sp)

**G4753 Structural Design – Wood.** Prerequisite: 3414 or equivalent. Material properties and behavior of wood. Analysis and design of solid and laminated structural members, connections, systems, trusses and arches. Current developments in structural wood design and research. (F)

**4803 Civil Engineering Professional Practice.** Prerequisites: 3253, 3364 and 3414. Nature of profession, duties and administrative responsibilities, organization and management of operating divisions with emphasis on role of architectural and civil engineering professional. Functional approach to planning and implementing public works needs with emphasis on role of architectural and civil engineering professional. (F)

**4993 Design of Building Systems.** Prerequisite: 4803 and senior standing. A capstone course emphasizing design of structural components and environmental systems of buildings. Requires students to integrate knowledge and skills from prerequisite courses to address a real-world, open-ended design problem. Required for architectural engineering students and is available to civil engineering students as a professional elective. (Sp)

**G5020 Special Topics in Civil Engineering.** 1 to 6 hours. Prerequisite: senior or graduate standing and permission of instructor. May be repeated with change of topic; maximum credit 12 hours. Examines subject matter in civil engineering not covered by existing course offerings as a regular course. (F, Sp, Su)

**G5021 Technical Communications.** Prerequisite: CEES graduate standing or permission of instructor. Focused on enabling students to improve oral and written communications skills. Examines appropriate formats for various technical publications, as well as methods and practices for developing effective oral presentations. Each student will be required to develop an oral presentation about his/her written product. (F)

**G5980 Research for Master's Thesis.** Variable enrollment, two to nine hours; maximum credit applicable toward degree, four hours. (F, Sp, Su)

## COURSES IN ENGINEERING (ENGR)

**1410 Freshman Engineering Orientation I.** Prerequisite: declared major in engineering. All entering freshmen with a declared engineering major are required to enroll. One hour of this seminar a week is in a large group setting where all students meet and cover details on all engineering disciplines. Additional topics would be continuums of majors, success in the College of Engineering, success at the University of Oklahoma, study abroad programs, advising issues, graduate school opportunities, career planning, and information related to technical/honor societies and participation. A second hour a week is a required small group session with an upper-class mentor from the College of Engineering Dean's Leadership Council. This second hour will focus on basic enrollment and retention strategies such as adding and dropping classes and choosing electives in addition to a weekly topic area. (F)

**2431 Electrical Circuits.** Prerequisite: Mathematics 2423 and Physics 2524 or concurrent enrollment. Introduction to basic principles of electrical circuits. Topics include circuits (DC circuits, AC circuits, resonance, AC transients, DC transients) static electrical fields, static magnetic fields, and electronics (diodes, operational amplifiers). (F, Sp)

**3401 Engineering Economics.** Prerequisite: Mathematics 1823. Introduction to basic principles of engineering economics. Topics include value and interest, cash flow diagrams, cash flow patterns, equivalence of cash flow patterns, unusual cash flows and interest periods, evaluating alternatives (annual equivalent cost comparisons, present equivalent cost comparisons, incremental approach, rate of return comparisons, benefit/cost comparisons, MARR, replacement problems, always ignore the past, break-even analysis), income tax and depreciation, and inflation. (F)

## COURSES IN ENGLISH (ENGL)

**3153 Technical Writing.** Prerequisite: 1213 and Engineering or hard science majors only. For students of the pure and applied sciences. Focuses on the forms of report writing most frequently encountered in research and industry. (F, Sp, Su)

## COURSES IN GEOLOGY (GEOL)

**1114 Physical Geology for Science and Engineering Majors.** Prerequisite: equivalent knowledge of high school chemistry, algebra and trigonometry. Laboratory included. Plate tectonics, the makeup of continents and mountain building. Heat flow, magnetism, gravity, rock deformation, earthquakes and the earth's interior. Surface processes including weathering, erosion, transport and deposition. Landforms, rivers, groundwater, glaciers, ocean processes, and volcanoes. Minerals and rocks. Application of geology to land-use, groundwater, mineral and fossil fuel exploration. **Laboratory** (F, Sp) [II-LAB]

## COURSES IN MATHEMATICS (MATH)

**1823 Calculus and Analytic Geometry I.** Prerequisite: 1523 at OU, or satisfactory score on the placement test, or, for incoming freshmen direct from high school, satisfactory score on the ACT/SAT. Topics covered include equations of straight lines; conic sections; functions, limits and continuity; differentiation; maximum-minimum theory and curve sketching. A student may not receive credit for this course and 1743. (F, Sp, Su) [I-M]

**2423 Calculus and Analytic Geometry II.** Prerequisite: 1823. Integration and its applications; the calculus of transcendental functions; techniques of integration; and the introduction to differential equations. A student may not receive credit for this course and 2123. (F, Sp, Su) [I-M]

**2433 Calculus and Analytic Geometry III.** Prerequisite: 2423. Polar coordinates, parametric equations, sequences, infinite series, vector analysis. (F, Sp, Su)

**2443 Calculus and Analytic Geometry IV.** Prerequisite: 2433. Vector calculus; functions of several variables; partial derivatives; gradients, extreme values and differentials of multivariate functions; multiple integrals; line and surface integrals. (F, Sp, Su)

**†G3113 Introduction to Ordinary Differential Equations.** Prerequisite: 2423. Duplicates two hours of 3413. First order ordinary differential equations, linear differential equations with constant coefficients, two-by-two linear systems, Laplace transformations, phase planes and stability. (F, Sp, Su)

## COURSES IN PHYSICS (PHYS)

**2514 General Physics for Engineering and Science Majors.** Prerequisite: Mathematics 1823. Not open to students with credit in 1205. Vectors, kinematics and dynamics of particles, work and energy systems of particles, rotational kinematics and dynamics, oscillations, gravitation, fluid mechanics, waves. (F, Sp, Su) [II-NL]

**2524 General Physics for Engineering and Science Majors.** Prerequisite: 2514 and Mathematics 2423. Not open to students with credit in 1215. Temperature, heat, thermodynamics, electricity, magnetism, optics. (F, Sp, Su)