REQUIREMENTS FOR THE BACHELOR OF SCIENCE IN ENVIRONMENTAL ENGINEERING/MASTER OF SCIENCE

B.S. Portion of the Program Accredited by the Engineering Accreditation Commission of ABET, **http://www.abet.org**

COLLEGE OF ENGINEERING

THE UNIVERSITY OF OKLAHOMA

For Students Entering the Oklahoma State System for Higher Education **Summer 2015 through Spring 2016**

GENERAL REQUIREMENTS

Total Credit Hours . . . . . **150-152•**

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.

Environmental Engineering

A390

Bachelor of Science in Environmental Engineering/Master of Science (Envir. Engr.) **F390**

OU encourages students to complete at least 30-31 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)	
	HIST 1483, U.S., 1492-1865, **or**	3		
	1493, U.S., 1865-Present (Core IV)		**CHEM 1415**, General Chemistry	5
	❖**MATH 1914**, Differential and Integral Calculus I (Core I)	4	❖**MATH 2924**, Differential and Integral Calculus II	4
	CEES 1112, Intro. to Civil Engr. & Environmental Science	2	**PHYS 2514**, General Physics for Engr. & Science (Core II)	4
	ENGR 1410, Freshman Engineering Orientation	0		
	TOTAL CREDIT HOURS	**17**	**TOTAL CREDIT HOURS**	**16**
SOPHOMORE	❖**MATH 2934**, Differential and Integral Calculus III	4	**HSCI 3333**, Inventing the Modern World (Core IV, West. Civ. & Culture), or approved substitute	3
	PHYS 2524, General Physics for Engr. & Science	4		
	*CEES **1000**, CEES Seminar	0	**MATH 3113**, Introduction to Ordinary Differential Equations	3
	CEES 2213, CADD Fundamentals	3		
	CEES 2113, Statics	3	*CEES **1000**, CEES Seminar	0
	CEES 2313, Water Quality Fundamentals	3	**CEES 2153**, Mechanics of Materials	3
			CEES 2223, Fluid Mechanics	3
			CEES 2323, Environmental Transport and Fate Process	3
	TOTAL CREDIT HOURS	**17**	**TOTAL CREDIT HOURS**	**15**
JUNIOR	**CHEM 3053**, Organic Chemistry	3	**ENGL 3153**, Technical Writing	3
	*CEES **1000**, CEES Seminar	0		
	CEES 3213, Water Resources Engineering	3	*CEES **1000**, CEES Seminar	0
	CEES 3364, Soil Mechanics	4	**CEES 3243**, Water & Wastewater Treatment Design	3
	ENGR 2431, Electrical Circuits	1	**CEES 4253**, Statistics and Probability	3
	ENGR 3401, Engineering Economics	1	**CEES 4943**, Air Quality Management	3
			ENGR 2461, Thermodynamics	1
	§Professional Elective	3		
			†Approved Elective: Social Science (Core III)	3
	TOTAL CREDIT HOURS	**15**	**TOTAL CREDIT HOURS**	**16**
	✦ Admission to the accelerated program is by application and requires a minimum GPA of 3.20.			
SENIOR	*CEES **1000,** CEES Seminar	0	**ANTH 4623,** Approaches to Cross-Cultural Human Problems or approved substitute (Core IV, Non-Western Civ.)	3
	CEES 4114, Aquatic Chemistry	4		
	CEES 4263, Hazardous and Solid Waste Management	3	**P SC 1113**, American Federal Government (Core III)	3
	CEES 4324, Environmental Biology and Ecology	4	*CEES **1000**, CEES Seminar	0
	CEES 4813, Environmental Science & Environmental Engineering Professional Practice	3	**CEES 4923**, Environmental Engineering Capstone (Capstone)	3
			§Professional Elective	3
			†Approved Elective: Artistic Forms (Core IV)	3
	TOTAL CREDIT HOURS	**14**	**TOTAL CREDIT HOURS**	**15**
	Students are eligible for graduate status upon graduation with the Bachelor of Science in Environmental Engineering.			
FIFTH YEAR	♦CEES **5980,** Thesis Research**, or** Graduate-level Elective	2-3	♦CEES **5980,** Thesis Research**, or** Graduate-level Elective	2-3
	CEES Graduate-level Elective	4	**CEES 5020,** Special Topics	2
	CEES Graduate-level Elective	3	**CEES 5021**, Technical Communications	1
	CEES Graduate-level Elective	3	**CEES** Graduate-level Elective	4
			CEES Graduate-level Elective	3
	TOTAL CREDIT HOURS	**12-13**	**TOTAL CREDIT HOURS**	**12-13**

♦Dependent upon whether a student chooses the thesis or non-thesis option. Non-thesis option additionally requires: **CEES Graduate-level Elective** (3 hrs.) and **CEES 5020 Special Topics** (2 hrs.), and **Comprehensive Exam** to be taken in the last semester of study.

✦**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.**

NOTE: Engineering transfer students may take ENGR 3410 in place of ENGR 1410 and ENGR 1420.

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.

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

• 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.

§ Professional electives can be chosen from any 3000-level or higher course in CEES. One three-hour professional elective can be taken outside CEES with adviser approval.

❖MATH 1823, 2423, 2433, and 2443 sequence can be substituted for MATH 1914, 2924, and 2934.

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 CHEMISTRY AND BIOCHEMISTRY (CHEM)

1315 General Chemistry. Prerequisite: Mathematics 1503 or 1643, or math ACT equal to or greater than 23. First of a two-semester sequence in general chemistry. Topics covered: basic measurement, gas laws and changes in state, stoichiometry, atomic theory, electron configuration, periodicity, bonding, molecular structure and thermochemistry. **Laboratory**(F, Sp, Su) [II-LAB]

1415 General Chemistry (Continued). Prerequisite: 1315 with a minimum grade of C or a satisfactory score on the chemistry placement examination. Topics covered include: nature of solutions, equilibrium, thermodynamics, acid and base properties, kinetics and electrochemistry. **Laboratory** (F, Sp, Su)

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 se mester that they are matriculated in CEES at OU after the freshman year, but in no case can a stu dent graduate without successfully completing four semesters of seminar. (F, Sp)

1112 Introduction to Civil Engineering and Environmental Science. Prerequisite: freshman only. 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. Prerequisites: Physics 2514 and Mathematics 2433 or 2934 or concurrent enrollment in Mathematics 2433 or 2934. Vector representation of forces and moments: general three-dimensional theorems of statics; centroids and moments of area and inertia. Free-body diagrams, equilibrium of a particle and of rigid bodies, distributed loads, friction and internal shear and moment loads. Analysis of trusses, frames, and machines. (F)

2153 Mechanics of Materials. Prerequisites: 2113 or Aerospace and Mechanical Engineering 2113 or Petroleum Engineering 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)

2213 CADD Fundamentals. Prerequisite: Math 2423 or 2924; Physics 2514 or PHYS 2414 or concurrent enrollment. Introduction to application software and computing tools relevant to civil engineering, environmental engineering, architectural engineering and environmental science, including programming, spreadsheets and computer-aided design. (F)

2223 Fluid Mechanics. Prerequisites: 2113 or Aerospace and Mechani cal Engineering 2113 or Petroleum Engineering 2113, Mathematics 3113 or concurrent enrollment. Coverage of the fundamentals of fluid statics and dynamics. For mulation of the equation of fluid flow, i.e., Navier-Stokes equations, Eulers equations, Bernoulli equations, etc. and their application. Exam ples of ideal fluid flow and viscous fluid flow, such as flow in open and closed conduits. (Sp)

2323 Environmental Transport and Fate Process. Prerequisite: 2313. Physicochemical and biological processes controlling contaminant distribution and fate; hydrological processes controlling contaminant transport; sources, prevention and remediation of environmental pollutants. (Sp)

3213 Water Resources Engineering. Prerequisite: 2223 or permission of instructor. Municipal water demands, surface water hydrology, ground water hydrology, water distribution systems, pump design, wastewater collection systems, storm water management, water law. (F)

3243 Water and Wastewater Treatment Design. Prerequisite: 2223. Design of municipal water and wastewater treatment plants. Emphasis is placed on the characterization of water and wastewater and physical, chemical and biological treatment methods. Sludge processing advanced treatment methods and treatment plant hydraulics are also considered. (Sp)

3364 Soil Mechanics. Prerequisite: CEES 2153 or Petroleum Engineering 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)

4114 Aquatic Chemistry (Slashlisted with 5114). Prerequisite: Senior standing and one year of general chemistry. Environmental kinetics and thermodynamics in aquatic systems; acid/base, precipitation/solubility, metal complexation and oxidation/reduction reactions; environmental colloidal and solid-liquid interface chemistry. No student may earn credit for both 4114 and 5114 or Environmental Science 4114 and 5114. **Laboratory** (F)

4253 Statistics and Probability. Prerequisite: MATH 2423 or 2924 and PHYS 2524 or 2424. Designed to help students understand the fundamentals of probability, statistics, reliability, and risk methods in support of decision making for future engineers and scientists. Fundamental concepts in probability and statistics will be reviewed and used throughout the course. Engineering decisions are often based on data that contain uncertainty; future scientists and engineers should understand how uncertainty affects calculated quantities, accuracy, precision, and reliability. (Sp)

G4263 Hazardous and Solid Waste Management. Prerequisite: junior or above status in the CEES or permission of instructor. Sources and types of solid wastes; identification and classification of hazardous wastes; waste handling, transportation, treatment and disposal techniques, federal and state legislation; and environmental and health effects. (F)

4324 Environmental Biology and Ecology (Slashlisted with 5324). Prerequisite: CEES2323. Examines applied environmental biology; biological consequences of environmentalimpacts; mitigation of environmental impacts via biogeochemical, ecological and microbial processes. No student may earn credit for both 4324 and 5324. **Laboratory** (F)

4813 Environmental Science and Environmental Engineering Professional Practice. Prerequisite: senior standing in environmental science or environmental engineering. Nature of profession, duties and administrative responsibilities. Organization and management of operating divisions with emphasis on role of environmental professional. Functional approach to planning and implementing public works needs with emphasis on role of environmental professional. (F)

4923 Environmental Engineering Capstone. Prerequisite: CEES 3213, CEES 4114, CEES 4324, CEES 4813; CEES 4253 or concurrent enrollment. Solution of major design problems by a team approach of disciplines. Problems to be varied within the area of Environmental Engineering (Water Resources; Water and Wastewater Treatment; Environmental Remediation; Hazardous and Solid Waste Design). The capstone project will be under direct faculty supervision. (Sp) [V]

4943 Air Quality Management. Prerequisite: MATH 2423 or 2924; and CHEM 1315. Important aspects of air quality will be covered, including air quality legislation, major sources and effects of air pollutants, monitoring, atmospheric dispersion, and air quality modeling. (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. Exam ines 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. (Sp)

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 or 2924; and Physics 2524 or concurrent enrollment. Introduction to basic principles of electrical circuits. Topics include DC circuits analysis, DC transients, static electrical fields, static magnetic fields, capacitors, inductors, and filters. (F, Sp)

2461 Thermodynamics. Prerequisite: Mathematics 2433 or 2934; and Physics 2524 or concurrent enrollment. Introduction to basic principles of thermodynamics. Topics include density, pressure, and temperature, the first law of thermodynamics for a system, the first law of thermodynamics for a control volume, the second law of thermodynamics, and psychometrics. (F)

3401 Engineering Economics. Prerequisite: Mathematics 1823 or 1914. 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 HISTORY OF SCIENCE (HSCI)

3333 Inventing the Modern World. Prerequisite: junior standing, or completion of one History of Science lower-division course, or permission of instructor. A survey of the history of technology since 1500. Emphasizes historical contexts and cultural meanings, not technical details, as it explores the key steps in the construction of our modern technological world. Materials include literature and film as well as non-fiction. (Sp) [IV-WC]

COURSES IN MATHEMATICS (MATH)

1914 Differential and Integral Calculus I. Prerequisite: satisfactory score on the placement test or, for incoming freshmen direct from high school, satisfactory score on the ACT/SAT. Duplicates three hours of 1823 and one hour of 2423. Limits and continuity, differentiation, applications of differentiation to optimization and curve sketching, integration, the fundamental theorem of calculus, the substitution rule, applications of integration to computation of areas. (F, Sp, Su) [I-M]

2924 Differential and Integral Calculus II. Prerequisite: 1914 with a grade of C or better. Duplicates two hours of 2423 and two hours of 2433. Further applications of integration, the natural logarithmic and exponential functions, indeterminate forms, techniques of integVectors ration, improper integrals, parametric curves and polar coordinates, infinite sequences and series. (F, Sp, Su)

2934 Differential and Integral Calculus III. Prerequisite: 2924 with a grade of C or better. Duplicates one hour of 2433 and three hours of 2443. Vectors and vector functions, functions of several variables, partial differentiation and gradients, multiple integration, line and surface integrals, Green-Stokes-Gauss theorems. (F, Sp, Su)

†G3113 Introduction to Ordinary Differential Equations. Prerequisite:MATH 2423 or MATH 2924. 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 or Mathematics 1914 with grade of C or better. 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 or 2924 with a grade of C or better. Not open to students with credit in 1215. Temperature, heat, thermodynamics, electricity, magnetism, optics. (F, Sp, Su)