

# CIVIL ENGINEERING CURRICULUM

## GENERAL CIVIL ENGINEERING CONCENTRATION



### DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

*B.S. in Civil Engineering---General Civil Engineering Concentration*

**FRESHMAN YEAR**

FIRST SEMESTER			SECOND SEMESTER		
Course		Units	Course		Units
MATH 231	Calculus I & Lab	4	MATH 232	Calculus II & Lab	4
CHEM 141	General Chemistry I	3	PHY 211	General Physics I	4
CHML 141	General Chemistry I Lab	1	PHYL 211	General Physics I Lab	1
ENG 104	Composition I	3	ENG 105	Composition II	3
HIST 101	History of Civilization	3	HIST 102	History of Civilization	3
UNIV 100	University Success	2	EN 105	Programming for Engineers	3
TOTAL = 16			TOTAL = 18		

**SOPHOMORE YEAR**

FIRST SEMESTER			SECOND SEMESTER		
Course		Units	Course		Units
MATH 233	Calculus III and Lab	4	MATH 368	Ordinary Differ. Equations I	3
EN 201	Engineering Graphics	2	ENG	English Option	3
PHY 212	General Physics II	4	EN 240	Strength of Materials	3
PHYL 212	General Physics II Lab	1	EN 220	Circuit Theory	3
BIO 101	Intro. To Biology & Lab or Earth & Space Science	3	EN 223	Engineering Mechanics II	3
BIOL 01 or SCI 205			SPCH	Speech Option	3
EN 222	Engineering Mech I	3	TOTAL = 18		
TOTAL = 17					

**JUNIOR YEAR**

FIRST SEMESTER			SECOND SEMESTER		
Course		Units	Course		Units
CIV 330, CIVL 330	Fluid Mech Lec, Lab	3	EN 355	Engineering Economy	3
MATH 307	Probability & Statistics for Eng.	3	CIV 360	Design of Steel Structures	2
CIVL 320	Structural Analysis	3	CIV 370	Water Res. Eng.	3
CIV 340, CIVL 340	Intro to Env. Eng. & Lab	4	CIV 380, CIVL 380	Intro To Geotechnical Eng. & Lab	4
PHIL	Philosophy Option	3	CIV 390	Intro. To Transp Eng.	3
TOTAL = 16			TOTAL = 15		

**SENIOR YEAR**

FIRST SEMESTER			SECOND SEMESTER		
Course		Units	Course		Units
CIV 410	Capstone Design I	3	CIV 411	Capstone Design II	3
CIV 420	Design. of Concrete Structures	2	CIV Elective	Civil Engineering Elective	3
CIV 421	Structural Eng. Lab	1	CIV Elective	Civil Eng. Elective	3
CIV 430	Foundation Eng.	3	ART	Fine Arts Option	3
CIV elective	Civil Eng Elective	3	CIV 461	Professional & Ethical Issues in Civil Engineering	1
CIV elective	Civil Engineering Elective	3	TOTAL = 13		
TOTAL = 15					

TOTAL HOURS: 128  
2008 Jackson State University

## CIVIL ENGINEERING TECHNICAL ELECTIVES

CIV 310 & CIVL 310 Eng. Surveying Lec. and Lab.  
CIV 441 Water & Wastewater Treatment Processes  
CIV 451 Computer Methods in Civil Engineering  
CIV 460 Design of Environmental Engineering Facilities  
CIV 465 Advanced Water Resources Engineering  
CIV 466 Advanced Design of Hydraulic Structures  
CIV 468 Hazardous Waste Engineering  
CIV 470 Urban Transportation Engrg System Design  
CIV 471 Principles of Geoenvironmental Engineering  
CIV 472 Applied Geotechnical Engineering Design  
CIV 475 Pavement Design  
CIV 476 Advanced Design of Steel Structures  
CIV 477 Advanced Design of Concrete Structures  
CIV 478 Design of Wood and Masonry Structures  
CIV 479 Evaluation, Maintenance, and Rehabilitation of Public Works Infrastructure  
CIV 481 Special Problems in Civil Engineering  
CIV 491 Internship in Civil Engineering I  
CIV 492 Internship in Civil Engineering II

At least one civil engineering elective must be chosen from CIV 441 or CIV 460.

At least one civil engineering elective must be chosen from CIV 470, CIV 475 or CIV 479.

The students are required to contact their advisers or department chair prior to taking any civil engineering elective.

## DEVELOPMENTAL COURSE REQUIREMENTS

ENG 002            Required for students with an ACT English subtest score of 16 or less.  
                         Strongly encouraged for students with English subtest score of 19 or less.

MATH 004           Required for students with an ACT Mathematics subtest score of 16 or  
                         less.  
                         Strongly encouraged for students with Mathematics subtest score of 19 or  
                         less.

RE 002             Required for students with an ACT Reading subtest score of 16 or less.  
                         Strongly encouraged for students with Reading subtest score of 19 or  
                         less.

GNST 101,102      Required for students taking two or more intermediate courses. Students  
                         in the Academic Support Program will not be permitted to take more than  
                         15 semester hours, including intermediate courses and the Academic  
                         Support Program.

Note: (a) Students who transfer 12 or more hours of college credit are exempt from GUID 100. (b) Students are required to take the Mathematics Placement Test to determine if they need to take any math courses before taking Math 231-Calculus I; (c) Students who fail the English Proficiency Exam, must register for ENG 399.

## SPEECH OPTIONS

SPCH 201 Speech Arts  
SPCH 334 Argumentation and Debate  
SPCH 355 Persuasion  
SPCH 430 Small Group Discussion

## PHILOSOPHY OPTIONS

PHIL 301 Introduction to Philosophy  
PHIL 416 Logic  
PHIL 208 Aesthetics  
PHIL 309 Ethics

## HUMANITIES AND FINE ARTS

ART 206 Art Appreciation  
MUS 205 Music Appreciation  
DR 201 Introduction to Drama  
ENG 201/202 Humanities  
ENG 205 World Literature  
FR 101/102 Elementary French  
FR 201/202 Intermediate French  
FR 213 French Phonetic Reading  
SP 101/102 Elementary Spanish  
SP 201/202 Intermediate Spanish

\*Note-students may take the equivalent of any foreign language the University offers.

## ENGLISH OPTIONS

ENG 213 Professional Writing  
ENG 206 Literature of Science  
ENG 205 World Literature

# CIVIL ENGINEERING CURRICULUM

## ENVIRONMENTAL ENGINEERING CONCENTRATION



### DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

*B.S. in Civil Engineering--Environmental Engineering Concentration*

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FIRST SEMESTER			SECOND SEMESTER		
Course		Units	Course		Units
MATH 231	Calculus I & Lab	4	MATH 232	Calculus II & Lab	4
CHEM 141	General Chemistry I	3	PHY 211	General Physics I	4
CHML 141	General Chemistry I Lab	1	PHYL 211	General Physics I Lab	1
ENG 104	Composition	3	ENG 105	Composition	3
HIST 101	History of Civilization	3	HIST 102	History of Civilization	3
UNIV 100	University Success	2	EN 105	Programming for Engineers	3
TOTAL = 16			TOTAL = 18		
FIRST SEMESTER			SECOND SEMESTER		
Course		Units	Course		Units
MATH 233	Calculus III & Lab	4	MATH 368	Ordinary Differ. Eq. I	3
EN 201	Engineering Graphics	2	ENG	English Option	3
CHEM 142, CHML 142	General Chemistry II & Lab	4	EN 220	Circuit Theory	3
BIO 101	Intro. To Biology & Lab or Earth & Space Science	3	CHEM 241, CHML 241	Organic Chemistry I & Lab	4
SCI 205	Space Science		EN 223	Engineering Mech. II	3
EN 222	Engineering Mech. I	3	EN 240	Strength of Materials	3
TOTAL = 16			TOTAL = 19		
FIRST SEMESTER			SECOND SEMESTER		
Course		Units	Course		Units
CIV 330, CIVL 330	Fluid Mech Lec, Lab	3	EN 355	Engineering Economy	3
MATH 307	Probability & Statistics for Eng.	3	CIV 360	Design of Steel Structures	2
CIV 320	Structural Analysis	3	CIV 370	Water Res. Eng.	3
CIV 340, CIVL 340	Intro to Env. Eng. & Lab	4	CIV 380, CIVL 380	Intro To Geotechnical Eng. & Lab	4
SPCH	Speech Option	3	CIV 390	Intro. To Transp. Eng.	3
TOTAL = 16			TOTAL = 15		
FIRST SEMESTER			SECOND SEMESTER		
Course		Units	Course		Units
CIV 410	Capstone Design I	3	CIV 411	Capstone Design II	3
CIV 420	Des. of Conc. Struc.	2	CIV Elective	Civil Eng. Elective	3
CIVL 421	Structural Eng Lab	1	PHIL	Philosophy Option	3
CIV 430	Foundation Eng.	3	ART	Fine Arts Option	3
CIV elective	Civil Eng. Elective	3			
CIV elective	Civil Eng. Elective	3	CIV 461	Professional Ethical Issues in Civil Eng.	1
TOTAL = 15			TOTAL = 13		

TOTAL HOURS: 128  
2008 Jackson State University

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CIV 310 & CIVL 310 Eng. Surveying Lec. and Lab.  
CIV 441 Water & Wastewater Treatment Processes  
CIV 451 Computer Methods in Civil Engineering  
CIV 460 Design of Environmental Engineering Facilities  
CIV 465 Advanced Water Resources Engineering  
CIV 466 Advanced Design of Hydraulic Structures  
CIV 468 Hazardous Waste Engineering  
CIV 470 Urban Transportation Engrg System Design  
CIV 471 Principles of Geoenvironmental Engineering  
CIV 472 Applied Geotechnical Engineering Design  
CIV 475 Pavement Design  
CIV 476 Advanced Design of Steel Structures  
CIV 477 Advanced Design of Concrete Structures  
CIV 478 Design of Wood and Masonry Structures  
CIV 479 Evaluation, Maintenance, and Rehabilitation of Public Works Infrastructure  
CIV 481 Special Problems in Civil Engineering  
CIV 491 Internship in Civil Engineering I  
CIV 492 Internship in Civil Engineering II

At least two civil engineering electives must be chosen from CIV 441, CIV 460, CIV 468, or CIV 471.  
At least one civil engineering elective must be chosen from CIV 470, CIV 475 or CIV 479.  
The students are required to contact their advisers or department chair prior to taking any civil engineering elective.

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Note: (a) Students who transfer 12 or more hours of college credit are exempt from GUID 100. (b) Students are required to take the Mathematics Placement Test to determine if they need to take any math courses before taking Math 231-Calculus I ; (b) Students who fail the English Proficiency Exam, must register for ENG 399.

## SPEECH OPTIONS

SPCH 201        Speech Arts  
SPCH 334        Argumentation and Debate  
SPCH 355        Persuasion  
SPCH 430        Small Group Discussion

## PHILOSOPHY OPTIONS

PHIL 301 Introduction to Philosophy  
PHIL 416 Logic  
PHIL 208 Aesthetics

PHIL 309 Ethics

HUMANITIES AND FINE ARTS

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MUS 205 Music Appreciation

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FR 213 French Phonetic Reading

SP 101/102 Elementary Spanish

SP 201/202 Intermediate Spanish

\*Note-students may take the equivalent of any foreign language the University offers.

ENGLISH OPTIONS

ENG 213 Professional Writing

ENG 206 Literature of Science

ENG 205 World Literature

## COURSE DESCRIPTIONS

EN 105 (3) Programming for Engineers. Prerequisite: MATH 111 or equivalent. The course introduces C/C++ programming concepts to engineering students. Its emphasis is on acquiring fundamental programming skills and learning appropriate syntax. Topics include variables, data types, expressions and statements, input/output formatting, modularization and subroutines, arrays, pointers and strings, and use of library functions. Course projects include program development for various engineering applications.

EN 201 (2) Engineering Graphics. Prerequisite: MATH 112 or MATH 118 or Equivalent. Develop skills to visualize and represent three-dimensional objects graphically, orthographic projection, pictorial drawings, graphics and charts, principles of computer-aided drafting and design (CADD) including substantial use of the AutoCAD software or equivalent, two and three-dimensional drafting and pictorial drawings using a CADD system, applications in various engineering disciplines and systems approach.

EN 220 (3) Circuit Theory. Prerequisite: MATH 232 and PHY 211. This course introduces concepts and basic laws in the analysis of AC and DC linear electric circuits. Topic include mesh and nodal analysis. Thevenin's and Norton's theorems, superposition principle, transients in RLC circuits, phasor notation, and frequency response.

EN 222 (3) Engineering Mechanics I. **Co-requisite:** PHY 211. Calculus-based statics of particles and rigid bodies; equilibrium; distributed forces; centroids; structures, trusses, frames, machines; forces in beams and cables; friction; moments of inertia, real life examples for engineering applications and systems approach.

EN 223 (3) Engineering Mechanics II. Prerequisite: EN 222, MATH 232. Calculus-based kinematics and kinetics of a particle. Planar kinematics of a rigid body: planar kinetics of a rigid body including force and acceleration; work and energy; impulse and momentum; vibrations, real life examples and systems approach.

EN 240 (3) Strength of Materials. Prerequisite: EN 222. Forces and stresses, axial loading, torsion, pure bending, transverse loading, shear force and bending moment diagrams, transformation of stress and strain, design of beams and shafts, deflection of beams, statically indeterminate problems, energy methods, columns, real life examples and systems approach.

EN 355 (3) Engineering Economy. Prerequisite: MATH 232 and junior standing. Introduction to economic principles, application of economic principles to multidisciplinary engineering problems; calculation of capitalized costs, present worth, prospective rates of return, and annual costs, economy of equipment replacement, market forces and firm analysis; **case studies and group project.**

## **CIVIL ENGINEERING COURSE DESCRIPTIONS**

CIV 310 (2) Engineering Surveying. Prerequisite: PHY 211, Co-requisite: CIV 311. Plane surveying, measurement of distances and angles, differential leveling, traverse adjustment and area computations, topographic surveying and contours, horizontal and vertical curves, surveying computations, elements of site plan, Professional ethics in surveying.

CIVL 310 (1) Engineering Surveying Laboratory. Prerequisite: PHY 211, Co-requisite: CIV 310. Field experience to measure surveying parameters including distances, angles, and elevations. Field notes, surveying equipment; critically analyze and interpret data, report writing.

CIV 320 (3) Structural Analysis. Prerequisite: EN 240. Analysis of statically determinate and indeterminate structures for fixed and moving loads. Equations of equilibrium and compatibility. Influence lines, and shear and moment envelopes. Analysis of forces and deflections in structures by methods of moment distribution, consistent deformation, and virtual work, computer analysis of structures, real life examples.

CIV 330 (2) Fluid Mechanics. Prerequisites: EN 223, EN 240, and MATH 368; Co-requisite: CIVL 330. Fluid properties and definition; fluid statics; fluid dynamics; Bernoulli equation and linear momentum; viscous flow; drag forces and boundary layer concepts; ideal flow; velocity potential and stream functions; dimensional analysis and dynamic similitude, real life problems.

CIVL 330 (1) Fluid Mechanics Laboratory. Co-requisite: CIV 330. Laboratory experience to measure fluid properties and apply principles for application in engineering design. The experiments will include pressure and velocity measurement, application of mass, energy, and momentum principles, energy losses, forces on immersed bodies, and flow measurement devices; critically analyze and interpret data, report writing.

CIV 340S (3) Introduction to Environmental Engineering. Prerequisites: CHEM 141; co-requisites: CIVL 340, CIV 330, and CIVL 330. Basic concepts of environmental engineering, local and global environmental issues, scientific, social, ethical, regulations and **public policy** on environmental protection; quantitative engineering analysis of sources, transformations, and effects of pollutants in water, air, and soil; introduction to water and wastewater treatment processes, air pollution control technologies, solid waste and hazardous waste management. This course requires the completion of a service learning component in specific areas of environmental engineering.

CIVL 340 (1) Environmental Engineering Laboratory. Prerequisite: CHEM 141, Co-requisites: CIV 340, CIV 330, CIVL 330. Experiments for the analysis of water, wastewater and certain solid wastes. Selected experiments may include determinations of water's or wastewater's pH, alkalinity, turbidity, hardness, and electric conductivity; solids, nitrogen species, dissolved oxygen, biochemical oxygen demand (BOD), chemical oxygen demand (COD), total organic carbon, and chlorinated compounds. Also included will be contaminant leaching test of some solid or hazardous wastes and absorption of contaminants by solid media. Critical analysis of experimental and interpretation of data and scientific presentation (reporting) of results are emphasized.

CIV 360 (2) Design of Steel Structures. Prerequisite: CIV 320. Engineering properties of steel, behavior and design of members subjected to fatigue, and combined loading and compression, plate girders, composite beams, open-web joists and connections. Methods of allowable design stress, and load resistance factor design. Elements of plastic analysis and design. Framing systems and loads for industrial buildings and bridges, design constraints.

CIV 370 (3) Water Resources Engineering. Prerequisites: CIV 330 and CIVL 330. This course is designed to review the fundamentals and practices of water resources engineering. Students will explore water resources engineering processes in the theoretical and applied realm in the fields of closed conduit (pipe) flow, open channel flow, surface water hydrology, and groundwater flow. Application of probability and statistical concepts along with the legal, economic and environmental considerations to the analysis and design of complex hydraulic and hydrologic systems will prepare interested students for future careers in water supply, wastewater, floodplain, storm water, and groundwater management.

CIV 380 (3) Introduction to Geotechnical Engineering. Prerequisites: EN 240, and CIV 330. Co-requisite: CIVL 380. Engineering soil classification, flow of water in soils, soil permeability and seepage, concepts of effective stress, stress and compressibility of soils, primary and secondary consolidation settlement, time rate of settlement, soil compaction, soil shear strength, introduction to slope stability, critical thinking and engineering judgment.

CIVL 380 (3) Geotech. Engrg. Laboratory. Co-requisite: CIV 380. Laboratory experiments to be performed by students to obtain soil parameters required for designed problems. Engineering classification of soils, grain size distribution, Atterberg limits, specific gravity, unconfined compression, compaction, in-situ field tests, consolidation, and shear strength determination, applications to design problems, critically analyze and interpret data, report writing.

CIV 390 (3) Introduction to Transportation Engineering. Co-requisite: CIV 380. Introduction to planning practice and procedure, design, operation, management, and maintenance of transportation systems, with emphasis on urban issues. General characteristics of transportation engineering systems including streets, highways, transit, airways. Capacity considerations including time-space diagrams. Elementary dynamics of traffic and functional consideration of routes and terminals. Components of transportation engineering facility design including geometric design, earthwork, and pavements.

CIV 410 (3) Capstone Design I. Prerequisite: CIV 340, CIV 360, CIV 390 and senior Standing in Civil Engineering. Group projects for senior students to work in teams to analyze and design civil engineering systems, and to consider various factors for design. Understanding of multi-disciplinary systems, interaction between design and construction professionals, realistic design constraints, economical issues, professional practice issues including importance of professional licensure and continuing education, contemporary issues, procurement of work, bidding vs. quality based selection processes, engineering professionalism and ethics. Developing teamwork and **leadership** skills. Oral presentation and written report is required.

CIV 411W (3) Capstone Design II. Prerequisite: CIV 411. Continuation of Capstone Design I. Group projects for senior students to work in teams to analyze and design civil

engineering systems, and to consider various factors for design. Understanding of multi-disciplinary systems, interaction between design and construction professionals, realistic design constraints, economical issues, professional practice issues including importance of professional licensure and continuing education, contemporary issues, procurement of work, bidding vs. quality based selection processes, engineering professionalism and ethics. Developing teamwork and leadership skills. Oral presentation and written report is required.

CIV 420 (2) Design of Concrete Structures. Prerequisites: CIV 320. Behavior of reinforced concrete structural elements; design and proportion of sections for strength and serviceability; background of specification requirements; strength design applied to beams, columns, and members under combined axial load and bending; continuous beams; introduction to prestressed concrete; application of basic concepts of project management to concrete structures.

CIVL 421 (1) Structural Engineering and Materials Testing Lab. Prerequisite EN 240. Engineering properties and behavior of concrete and other structural members. Test of a small-scale model structures. Use of computer-based data acquisition and interpretation systems for comparison of experimental and theoretically predicted behavior; nondestructive testing, critically analyze and interpret data, report writing.

CIV 430 (3) Foundation Engineering Prerequisite: CIV 380. Shallow foundation analysis and factors to consider for design, subsurface investigations for design, bearing capacity and settlement, mat foundations, piles, caissons, lateral earth pressures and retaining walls, site improvement techniques, design of sheet pile walls and support systems, critical thinking and engineering judgment, ethical considerations.

CIV 441 (3) Water and Wastewater Treatment Processes. Prerequisites: CHEM 141, CHML 141, CIV 340, CIVL 340. Theories, engineering principles, and design of modern water supply and wastewater treatment processes. Physical-chemical processes including screening, sedimentation, aeration, coagulation, flocculation, filtration, absorption, softening, and disinfection. Biological processes including activated sludge process and anaerobic processes for wastewater and sludge digestion, with emphasis on urban issues. Completion of a design project.

CIV 451 (3) Computer Methods in Civil Engineering. Prerequisites: EN 105, MATH 368, and departmental approval. Fundamentals of analog and digital computers. Organization of problems for computational solution, flow charts, programming, simulation of nonlinear physical systems for application in engineering design, numerical methods in civil engineering. Case studies in civil engineering.

CIV 460 (3) Design of Environmental Engineering Facilities. Prerequisites: CIV 330, CIV 340 and CIVL 340. Analysis and design considerations for environmental engineering facilities such as water and wastewater treatment plants; physical engineering management of solid and hazardous waste, design constraints, resources recovery; biological processes; economical, ethical, societal and other professional considerations, urban issues, completion of a major design project.

CIV 461 (1) Professional & Ethical Issues in Civil Engineering. Prerequisites: senior standing in civil engineering. The task of this course is to reflect on the professional and ethical responsibilities of engineers, which can sometimes conflict with technical

responsibilities. This course will articulate an ethical framework for engineers by critically reflecting on engineering practice and examining the ethical challenges that confront engineers working within teams and organizations. The course covers issues such as the social responsibility of engineers, attitudes, truth-telling and disclosure, whistle-blowing, contemporary issues, risk-assessment, and the importance of professional licensure.

CIV 465 (3) Advanced Water Resources Engineering. Prerequisite: CIV 370. Advanced engineering hydrology, advanced hydraulic structures, hydraulic similitude and modeling, wave action, flow over spillways, optimization of water resources systems, design constraints, introduction to GIS applications to water resources engineering, completion of a major design project.

CIV 466 (3) Advanced Design of Hydraulic Structures. Prerequisite: CIV 370. Analysis and characteristics of flow in open channels (natural and artificial); channel design considerations including uniform flow (rivers, sewers), flow measuring devices (weirs, flumes), gradually varied flow (backwater and other flow profiles, flood routing), rapidly varied flow (hydraulic jump, spillways), and channel design problems (geometric considerations, scour, channel stabilization, sediment transport); analysis and design of hydraulic structures such as dams, spillways etc. based on economic, environmental, ethical, political, societal, health, urban issues, and safety considerations.

CIV 468 (3) Hazardous Waste Engineering. Prerequisite: CHEM 241, CHML 241, CIV 340, CIVL 340. Comprehensive study of the complex, interdisciplinary engineering principles involved in hazardous waste handling, collection, transportation, treatment, and disposal. Also covered are waste minimization, site remediation, and regulations important for engineering applications. Design constraints, engineering judgment, and ethical responsibility are covered. Contemporary hazardous waste issues and urban issues are also addressed.

CIV 470 (3) Urban Transportation Engrg System Design. Prerequisite: CIV 310, CIVL 311, CIV 390. Advanced design of highway systems, vehicle and driver characteristics, highway capacity, design of urban streets and expressways. Design constraints. Individual and team design projects oriented toward the solution of local urban transportation problems, societal and economical considerations.

CIV 471 (3) Principles of Geoenvironmental Engineering. Prerequisite: CIV 380. Topics in geoenvironmental engineering in an urban environment. landfill design and incineration options. Stability of landfills, geotechnical characteristics of landfills, liner systems. Waste characterization, minimization, collection, treatment, transport and disposal. Leachate characteristics and potential groundwater contamination, design constraints. Legal and ethical considerations.

CIV 472 (3) Applied Geotechnical Engineering Design. Pre or co-requisite: CIV 430. Practical real life urban projects and advanced laboratory experience in geotechnical engineering, construction dewatering, construction issues, safety and economy, urban geotechnical engineering issues, preparation of subsurface investigation and geotechnical engineering reports, ethical considerations, oral presentation.

CIV 475 (3) Pavement Design. Prerequisite: CIV 380 and CIV 390. Aggregate, binder systems. Theory and design of pavement structures, rigid and flexible pavement design,

subgrade materials, pavement management, nondestructive testing, pavement maintenance, design constraints, infrastructure maintenance, major design project.

CIV 476 (3) Advanced Design of Steel Structures. Prerequisite: CIV 360. Behavior and design of members subjected to fatigue, dynamic, combined loading. Methods of allowable design stress, and load resistance factor design. Design of continuous beams, plate girders, composite beams, open-web joists, connections, torsion and plastic analysis and design. Framing systems and loads for industrial buildings and bridges, design constraints and a major design project.

CIV 477 (3) Advanced Design of Concrete Structures. Prerequisite: CIV 420. Theory and design of reinforced concrete continuous beams, slender columns, two-way-slabs, footings, retaining walls, shear walls and multi-story buildings. Design for torsion and design constraints. Framing systems and loads for buildings and bridges, design constraints and a major design project.

CIV 478 (3) Design of Wood and Masonry Structures. Prerequisite: CIV 420. Engineering Properties and behavior of wood for analysis and design of wood beams, walls and diaphragms. Engineering properties and behavior of masonry for analysis and design of masonry walls, columns and shear walls. Framing systems and loads for multi-story buildings, design constraints and a major design project.

CIV 479 (3) Evaluation, Maintenance, and Rehabilitation of Public Works Infrastructure. Prerequisites: CIV 390, CIV 475. Evaluation, maintenance, and rehabilitation of deteriorated infrastructure systems by considering life cycle costs and long-term performance. Understanding rehabilitation alternatives in the practical field and designing rehabilitation schemes based on the non-destructive testing methods and economical considerations.

CIV 481 (3) Special Problems in Civil Engineering. Prerequisite: Departmental Approval. Individual investigation in a recognized major area of civil engineering of particular interest to the students that is not normally covered in regular courses. May include a co-op project.

CIV 491 (1-3) Internships in Civil Engineering I. Prerequisites: Junior or senior standing. Students work as interns with engineering firms or research laboratories to receive career-related training under the supervision of qualified engineers. The projects and tasks for the internship must be approved by both the work supervisor and the departmental instructor. Progress reports and final report in both writing and oral presentation are required. A minimum of 50 hours per credit is required.

CIV 492 (1-3) Internships in Civil Engineering II. Prerequisite: CIV 491. Continuation of the internship projects or tasks that the students conducted in the previous CIV 481 course and need more time to finish, or start of the second internship with engineering firms or research laboratories. The projects and tasks for the internship must be approved by both the work supervisor and the departmental instructor. Progress reports and final report in both writing and oral presentation are required. A minimum of 50 hours per credit is required.

***Difference between General Civil Engineering and Environmental Engineering Concentrations***

The curricula for the two concentrations are very similar to each other. For the Environmental concentration, two additional chemistry courses (CHEM 142 CHML 142 and CHEM 241, CHML 241) are required, and General Physics II (PHY 212 and PHYL 212) is not a required course. The environmental concentration requires two civil engineering electives be chosen from CIV 441, CIV 460, CIV 468, or CIV 471. These are summarized below.

<b>Course No.</b>	<b>Course Name</b>	<b>No. of Credits Included in General Civil Eng. Concentration</b>	<b>Included in Environmental Eng. Concentration</b>
PHY 212 & PHYL 212	General Physics II & Lab (5 Credits)	5	
CHEM 142 & CHML 142	General Chemistry II & Lab (4 Credits)		4
CHEM 241 & CHML 241	Organic Chemistry I & Lab (4 Credits)		4
CIV Electives	Civil Engineering Electives (9 or 12 Credits) <sup>a</sup> , See below.	12	9
Total No. of Credits		17	17

<sup>a</sup>See the technical electives requirements for each concentration.

**GENERAL CIVIL ENGINEERING CONCENTRATION TECHNICAL ELECTIVES REQUIREMENTS**

At least one civil engineering elective must be chosen from CIV 441 or CIV 460. At least one civil engineering elective must be chosen from CIV 470, CIV 475 or CIV 479.

**ENVIRONMENTAL ENGINEERING CONCENTRATION TECHNICAL ELECTIVES REQUIREMENTS**

At least two civil engineering electives must be chosen from CIV 441, CIV 460, CIV 468, or CIV 471. At least one civil engineering elective must be chosen from CIV 470, CIV 475 or CIV 479.