

ADDENDUM TO CIVIL ENGINEERING PROGRAM

The information below replaces the 2010-2013 Civil Engineering catalog section, effective July 1, 2011. Students matriculating under the 2010-2013 catalog, however, have the option to follow the original 2010-2013 program, or the revised program outlined below; students may wish to seek the advice of their departmental advisor or chairperson in making this determination.

CIVIL ENGINEERING

Chairperson of Department: PROFESSOR REGINALD L. AMORY; Samuel P. Massie Chair of Excellence in the Environmental Disciplines: Professor JIANG LI; Associate Professors: IHEANYI ERONINI, MANOJ JHA, GBEKELOLUWA B. OGUNTOMEIN; Assistant Professors: A. BERT DAVY, INDRANIL GOSWAMI, JAMES HUNTER; Lecturer: CHARLES O. OLUOKUN.

THE MAJOR IN CIVIL ENGINEERING

The Civil Engineering Department provides a program of study in the planning, design and management of civil infrastructure and service systems. Specialty areas of study offered include transportation engineering, structural engineering, geotechnical engineering, environmental, hydraulic/water resource engineering, and construction engineering and management.

OBJECTIVES

The Program Educational Objectives of the Civil Engineering Department are to: (1) grow the number of graduates from the program that assume top managerial and leadership roles in their chosen professional careers; (2) increase the percentage of graduates passing the Fundamentals of Engineering Examination within three years of graduation; (3) produce graduates of the program that will be well represented in organizations and areas of practice engaged in high profile and technologically advanced civil engineering systems and process; and (4) grow the number of graduates of the program that continue their professional development through continuing education and lifelong learning.

STUDENT OUTCOMES

The civil engineering program student outcomes are:

- (a) an ability to apply knowledge of mathematics, science and engineering
- (b) an ability to design and conduct experiments as well as to analyze and interpret data
- (c) an ability to design a civil engineering system to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability
- (d) an ability to function on multi-disciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary engineering issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

REQUIREMENTS FOR THE B.S. DEGREE IN CIVIL ENGINEERING

A minimum of 128 credit hours are required to graduate with a B.S. degree in Civil Engineering (B.S.C.E.). These credit hours are distributed as follows:

General Education & University Requirements	50
Mathematics and Science Requirements	27
Engineering Requirements	51
TOTAL	128

The required courses are listed under the three sub-groups below.

A. General Education and University Requirements

<i>Course #</i>	<i>Course Title</i>	<i>Credit</i>
BIOL 101	Introduction to Biology	4
CEGR 107	Computer-Aided Engineering Graphics, Analysis and Design	3
CHEM 110	General Chemistry	5
ECON 212	Principles of Economics II	3
ENGL 101	Freshman Composition I	3
ENGL 102	Freshman Composition II	3
HEED 100	Health Education	2
HIST 101/105	World History I/ History of the U.S. I	3
HIST 102/106	World History II/History of the U.S. II	3
HIST 350	Introduction to African Diaspora	3
HUMA 201	Introduction to Humanities I	3
HUMA 202	Introduction to Humanities II	3
PHIL 220	Ethics and Values	3
MATH 241	Calculus I	4
OREN 104	Introduction to Engineering	1
PHEC XXX	Physical Education Elective	1
PHIL 109	Introduction to Logic	3
Total Credits		50

B. Mathematics and Science Requirements

<i>Course #</i>	<i>Course Title</i>	<i>Credit</i>
CEGR 307	Computer Methods and Programming for Civil Engineers	3
MATH 242	Calculus II	4
MATH 243	Calculus III	4
MATH 331	Probability and Statistics	3
MATH 340	Introduction to Differential Equations	3
PHYS 205	General Physics I	5
PHYS 206	General Physics II	5
Total Credits		27

C. Engineering Requirements

<i>Course #</i>	<i>Course Title</i>	<i>Credit</i>
CEGR 106	Introduction to Civil Engineering	2
CEGR 110	Geospatial Technologies in Civil Engineering	3
CEGR 202	Statics	3
CEGR 212	Mechanics of Materials & Lab	3

CEGR 214	Fluid Mechanics and Laboratory	3
CEGR 302	Dynamics	3
CEGR 324	Structural Analysis I and Laboratory	3
CEGR 325	Geotechnical Engineering and Laboratory	3
CEGR 332	Hydraulic/Water Res Eng and Laboratory	3
CEGR 338	Environmental Engineering I and Laboratory	3
CEGR 400	Project Management, Finance and Entrepreneurship	3
CEGR 416	Transportation Engineering	3
CEGR 436	Elementary Structural Design	3
CEGR XXX	Civil Engineering Technical Electives	6
XEGR XXX	Multidisciplinary Engineering Elective	3
CEGR 492	Senior Review and Project Proposal	2
CEGR 493	Senior Project	2
Total Credits		51

IMPORTANT

The prerequisite requirements will be strictly enforced. Students **MUST** have the prescribed prerequisites before registering for a course.

CIVIL ENGINEERING COURSE OFFERINGS

OREN 104 INTRODUCTION TO ENGINEERING (FRESHMAN ORIENTATION FOR SCHOOL OF ENGINEERING) *Two hours lecture; 1 credit.* This course is designed to prepare students for the rigors of earning an engineering degree. It introduces students to the expectations and demands of higher education, to the legacy and traditions of Morgan State University, to college success strategies, and to the broad array of career opportunities in the fields of engineering. Students enrolled in this class are required to attend selected University convocations, School of Engineering programs, and other prescribed activities. They are also required to hold conferences with their faculty advisors. Students transferring 24 or more credits to the University when admitted are exempt from this requirement. (FALL/SPRING)

CEGR 106 INTRODUCTION TO CIVIL ENGINEERING *Two hours lecture; 2 credits.* This introductory course to civil and environmental engineering will introduce students to the concepts of engineering design by exposure to several design problems from various areas of civil engineering including: structural, transportation, water resource, geotechnical and environmental engineering. Students will also be exposed to engineering problem solving techniques, ethics, business practices and values; their prior exposure to visualization, geometry and trigonometric concepts will be reinforced; and they will be required to complete a major civil engineering project working in teams. **Electronic Portfolio:** An assignment in which each student, following departmental guidelines, creates a short electronic portfolio that would be continuously updated with subsequent projects as the student matriculates through the curriculum. **Prerequisite:** OREN 104. (FALL/SPRING)

CEGR 107 COMPUTER AIDED ENGINEERING GRAPHICS, ANALYSIS & DESIGN *Two hours lecture, three hours laboratory; 3 credits.* This course introduces students to computer-aided engineering graphics and engineering analysis in the context of defining, demonstrating, and solving interesting but simple visualization and design problems in civil engineering; Review of geometry and trigonometry in conjunction with related computer graphics functions; data reduction and analysis,

graphing and presentation. Introduction to Computer-Aided Drafting and Design (CADD) and to contemporary CAD/3D modeling and analysis software for civil engineers. Modeling exercises and design projects, with students working in teams and using computer analysis and design, spreadsheets and technical word processing and presentation programs. **Prerequisite:** None. (FALL/SPRING)

CEGR 110 GEOSPATIAL TECHNOLOGIES IN CIVIL ENGINEERING *Two hours lecture, three hours laboratory; 3 credits.* The course provides students with comprehensive knowledge and understanding of geospatial technologies/sciences and their applications in Civil Engineering. It will highlight surveying, geographic information systems (GIS), differential global positioning system (DGPS), remote sensing, and spectroradiometer concepts, principles, and techniques for developing appropriate skills for their integration and applications in civil engineering. Students will actively participate in data acquisition, mapping, surveying, site geometrics, and geology. Lectures include geospatial features, attributes, image exploitation, and relational database. Labs include training in ArcGIS/ArcView, ENVI, GeoMedia Suite, TerraSync and Pathfinder Office software. Differential correction of field data, analyses, syntheses and applications will be provided. Term project, with oral presentation and written report will form part of this course. **Prerequisite:** None. (FALL/SPRING)

CEGR 202 STATICS *Two hours lecture, three hours practicum; 3 credits.* Review of relevant concepts from geometry, algebra and calculus. Representation and resolution of vectors. Resultants of force and couple systems by graphical and analytical approaches. Particle interaction forces; Coulomb friction, spring behavior. Application of Free Body Diagrams in problem solving. Equilibrium of particles and rigid bodies. Analysis of simple trusses and frames. Center of gravity, center of mass, and centroid of area. Reduction of distributed normal loads, internal reactions, area moments of inertia. Practicum: Problem solving in statics; forces and force components, moments and equilibrium, introduction to computer-aided design and simulations of simple structural systems. Project(s) would require oral and visual presentation and written report. **Prerequisites:** CEGR 107 (CAE Graphics, Analysis & Design) and PHYS 205 (General Physics I). **Co-requisite:** MATH 242 (Calculus II). (FALL/SPRING)

CEGR 212 MECHANICS OF MATERIALS AND LABORATORY *Two hours lecture, three hours laboratory; 3 credits.* Stress and strain for various types of loads – axial, shear, torsion and bending. Constitutive Laws. Multidimensional Hooke's Law. Stress concentration. Introduction to Indeterminate analysis – Equilibrium vs. Compatibility. Combined stresses in 2D and 3D using Mohr's Circle. Laboratory exercises to include tension, compression, bending and torsion. Concrete mix design and asphalt mix design. Elastic vs. plastic behavior of metals. Use of basic finite element software to investigate concepts of stress and deformation caused by external loads. **Prerequisite:** CEGR 202 (Statics). (FALL/SPRING)

CEGR 214 FLUID MECHANICS AND LABORATORY *Two hours lecture, three hours laboratory; 3 credits.* The lecture includes the following: studies of fluid properties; fluid statics and dynamics involving integral and differential forms of fluid behavior; viscous flow in pipes; losses in bends, fittings, valves, and flanges; and similitude and dimensional analysis. The laboratory includes properties of fluids; viscosity of fluids; vortex apparatus; stability of floating bodies; flow measurements; losses in straight runs of pipes; and losses in bends, fittings, valves, and flanges. **Prerequisite:** MATH 243 (Calculus III). **Co-requisite:** MATH 340 (Differential Equations). (FALL/SPRING)

CEGR 302 DYNAMICS *Three hours lecture; 3 credits.* Kinematics and kinetics of particles and rigid bodies in one- and two-dimensional motion. Frictional behavior, Mass moments of inertia. Motion of particle systems and simple deformable mass systems. Use of impulse and momentum methods. Application of principles of work, energy and power. Simple 3D gyroscopic motion. Introduction to free and forced vibrations of particles and simple rigid bodies. Coursework includes problems involving

computer simulations. **Prerequisites:** CEGR 202 (Statics) and CEGR 307 (Computer Methods & Programming for CE). (FALL/SPRING)

CEGR 304 ENGINEERING MECHANICS *Four hours lecture; 4 credits.* Resolution, composition, and equilibrium of forces. Analysis of force systems; center of gravity; and moments of inertia. Motion study; Newtons Laws and work-energy, impulse-momentum, and power. **Closed to Civil Engineering Majors.** **Prerequisites:** MATH 242 (Calculus II) and PHYS 205 (General Physics I). (FALL/SPRING).

CEGR 307 COMPUTER METHODS AND PROGRAMMING FOR CIVIL ENGINEERING *Two hours lecture, three hours laboratory; 3 credits.* This course will introduce and reinforce computer methods and programming in Civil Engineering Analysis and Design. Overview of basic linear algebra, relevant numerical analysis algorithms, basic algorithm development and programming; types of variables, objects and classes, conversion of mathematical equations to objects and classes, and generation of corresponding software. Application of Spreadsheet and Computational-Math software to routine analysis and design; development of e-books in writing technical reports. Further exposure to general purpose CAD, Modeling and Analysis software. Examples will draw from diverse sub disciplines within Civil Engineering. **Prerequisite:** CEGR 107 (Computer-Aided Engineering Graphics, Analysis and Design), PHYS 206 (General Physics II), MATH 243 (Calculus III) and MATH 340 (Differential Equations). (FALL/SPRING)

CEGR 324 STRUCTURAL ANALYSIS I AND LABORATORY *Two hours lecture, three hours laboratory; 3 credits.* Structural forms; structural load definitions; statically determinate structures; reactions; axial force, shear, bending moment and qualitative deflected shape diagrams for determinate beams and frames; cable-supported structures; arches; influence lines; Computer programming assignments are incorporated into the coursework. **Prerequisites:** CEGR 202 (Statics), CEGR 212 (Mechanics of Materials & Lab). **Co-requisite:** CEGR 307 (Computer Methods & Programming for CE). (FALL/SPRING)

CEGR 325 GEOTECHNICAL ENGINEERING AND LABORATORY *Two hours lecture, three hours laboratory; 3 credits.* Basic physical and mechanical structural characteristics of geotechnical engineering applied to soil classification, permeability and seepage, in-situ stresses and compressibility, lateral earth pressures, slope stability, and bearing capacity of shallow foundations. **Prerequisites:** CEGR 202 (Statics) and CEGR 212 (Mechanics of Materials & Lab). (FALL/SPRING)

CEGR 332 HYDRAULIC/WATER RESOURCE ENGINEERING AND LABORATORY *Two hours lecture, three hours laboratory; 3 credits.* This course applies the knowledge of fluid mechanics to the planning and design of hydraulic and water resources systems which include hydrology, open-channels, flows in closed conduits and pumping stations. In addition, the planning and design of ground water and well-field systems, dams, and reservoirs are also included. **Prerequisites:** CEGR 214 (Fluid Mechanics & Lab). **Co-requisite:** CEGR 307 (Computer Methods & Programming for CE). (FALL/SPRING)

CEGR 338 ENVIRONMENTAL ENGINEERING I AND LABORATORY *Two hours lecture, three hours laboratory; 3 credits.* The lecture applies the knowledge of fluid mechanics to the planning and design of elements of water treatment plants and elements of wastewater treatment plants, and the design of sewers and water distribution system hydraulics. The laboratory applies the knowledge of general chemistry to sanitary chemical analyses, which include the various forms of solids, pH measurements, and salinity. The laboratory will also introduce the students to the use of the atomic absorption spectrophotometer. **Prerequisites:** BIOL 101 (Intro to Biology I), CEGR 106 (Intro to Civil

Eng), CHEM 110 (Gen Chemistry for Eng), CEGR 214 (Fluid Mechanics & Lab). **Co-requisite:** CEGR 307 (Computer Methods & Programming for CE). (FALL/SPRING)

CEGR 400 PROJECT MANAGEMENT, FINANCE & ENTREPRENEURSHIP *Two hours lecture, three hours practicum; 3 credits.* The principles and techniques of project management in the planning, design and operation of civil engineering infrastructure and service systems. Specific topics and project management techniques covered include: Project manager and Team building and leadership, Economic analysis in project selection, Project Financing and entrepreneurship, project planning, project organization Project cost estimation, Network analysis and related applications to Project scheduling (i.e. PERT-CPM), Project Monitoring and control using Microsoft project software and project termination process. **Prerequisite:** ECON 212 (Prin. of Econ II), MATH 331 Probability & Statistics) and CEGR 307 (Computer Methods & Programming for CE). (FALL/SPRING)

CEGR 416 TRANSPORTATION ENGINEERING *Three hours lecture; 3 credits.* Engineering and planning for transportation facilities with emphasis on ground transportation. Topics include: vehicle motion, vehicle flow models, human factors, geometric design, safety, capacity analysis and transportation planning. **Co-requisite:** ECON 212 (Prin. of Econ II). (FALL/SPRING)

CEGR 436 ELEMENTARY STRUCTURAL DESIGN *Three hours lecture; 3 credits.* Introduction to design principles, the AISC Steel Construction Manual and the ACI Concrete Code. Safety factors. Structural properties of steel and concrete. Design of tension members. Design of steel and reinforced concrete beams and columns. Design of steel trusses. **Prerequisite:** CEGR 324 (Structural Analysis I & Lab). (FALL/SPRING)

CEGR 450 STRUCTURAL ANALYSIS II *Three hours lecture; 3 credits.* Deflection of statically determinate structures using virtual work and moment area methods; analysis of statically indeterminate structures; approximate methods, stiffness and flexibility matrices, solution by digital computer. Plastic method of analysis. **Prerequisite:** CEGR 324 (Structural Analysis I & Lab). (FALL/SPRING)

CEGR 451 DESIGN OF CONCRETE STRUCTURES *Three hours lecture; 3 credits.* Review of structural properties of concrete and reinforcing steel, building codes, design of slabs, doubly reinforced and T-beams, short and slender columns, footings and retaining walls; deflections, crack control, development lengths and splices; term project. **Prerequisite:** CEGR 436 (Elem Structural Design). (FALL)

CEGR 452 DESIGN OF STEEL STRUCTURES *Three hours lecture; 3 credits.* Design of bolted and welded connections for tension members, beams and columns, standard connections; composite sections; built up beams and plate girders, continuous beams; complete construction; term project. **Prerequisite:** CEGR 436 (Elem Structural Design). (SPRING)

CEGR 453 RELIABILITY BASED DESIGN IN CIVIL ENGINEERING *Three hours lecture; 3 credits.* Systems reliability and reliability analysis. Includes measures of reliability, reliability index, reliability bounds and other related measurements. **Prerequisite:** MATH 331 (Probability & Statistics). (OFFERED AS NEEDED)

CEGR 454 FOUNDATION ENGINEERING *Three hours lecture; 3 credits.* Application of the principles of soil mechanics and geotechnical engineering to the design of shallow foundations, mat foundations, lateral earth pressure and retaining walls, braced cuts, and pile foundations. **Prerequisite:** CEGR 325 (Geotechnical Eng & Lab). (SPRING)

CEGR 455 SEEPAGE, DRAINAGE, AND GROUNDWATER *Three hours lecture; 3 credits.* Introduction to groundwater hydrology, well hydraulics, permeability, seepage, flow nets, filter criteria, dewatering, slope stabilization, practical applications. **Prerequisite:** CEGR 325 (Geotechnical Eng & Lab). (OFFERED AS NEEDED)

CEGR 456 EARTH STRUCTURES AND SLOPES *Three hours lecture; 3 credits.* Earth dams, embankments and natural slopes. Site investigation, soil properties and compaction. Slope stability analysis and landslide prevention. Earthquake effects. Case studies. **Prerequisite:** CEGR 325 (Geotechnical Eng & Lab). (OFFERED AS NEEDED)

CEGR 457 GEOTECHNICAL ENGINEERING *Three hours lecture, 3 credits.* Geologic overview, site investigations, subsurface stresses and stress path analyses, shear strength and laboratory test, stress-strain relations, application of soil mechanics theories and site improvement, and slope stability analysis. **Prerequisite:** CEGR 325 (Geotechnical Eng & Lab). (FALL)

CEGR 458 BIOLOGICAL WASTEWATER TREATMENT *Three hours lecture; 3 credits.* This course covers the planning and design of the unit operations and unit processes of biological wastewater treatment. Topics include principles of biological treatment; biological lagoons; trickling filter; activated sludge process; anaerobic and aerobic digestion of sludge. **Prerequisite:** CEGR 338 (Environmental Engineering I & Lab). (OFFERED AS NEEDED)

CEGR 459 WATER SUPPLY ENGINEERING *Three hours lecture; 3 credits.* This course covers planning and design in water supply engineering which includes raw water supply sources, reservoir sizing, pumping and transmission of raw and treated waters, groundwater, distribution systems, treatment processes and chemistry and microbiology of raw and treated waters. **Prerequisite:** CEGR 338 (Environmental Engineering I & Lab). (FALL)

CEGR 460 HAZARDOUS WASTE MANAGEMENT: *Three hours lecture; 3 credits.* This course is an in-depth study of hazardous waste management covering the scientific and engineering principles of hazardous waste management. Specific topics covered include properties, behavior (pathways, fates and disposition) of hazardous materials in air, groundwater and soil, exposure assessment, regulations, treatment and remediation technologies of hazardous waste materials. **Prerequisites:** BIOL 101 (Intro to Biology I), CHEM 110 (Gen. Chemistry for Eng) and CEGR 332 (Hydraulic/Water Resource Eng & Lab). (OFFERED AS NEEDED)

CEGR 463 PHYSICAL-CHEMICAL TREATMENT OF WATER AND WASTEWATER *Three hours lecture; 3 credits.* This course covers the planning and design of the unit operations and unit processes of water and wastewater treatment. Topics include sedimentation; flotation; disinfection; coagulation; flocculation; filtration; carbon absorption; reverse osmosis; ion exchange and thickening. **Prerequisite:** CEGR 338 (Environ Eng I & Lab). (SPRING)

CEGR 464 ENVIRONMENTAL ENGINEERING II *Three hours lecture; 3 credits.* This course covers planning and design in environmental engineering which include environmental engineering hydrology, hydraulics and pneumatics; air pollution control; and solid waste characteristics, management and control. **Prerequisites:** CHEM 110 (Gen. Chemistry for Eng) and CEGR 214 (Fluid Mechanics & Lab). (FALL)

CEGR 465 TRAFFIC ENGINEERING *Three hours lecture; 3 credits.* The principles of traffic engineering involving the analysis, planning and design of roads, streets and highways, and their related networks. Coverage includes the dynamics of traffic flows; traffic studies and data collection; capacity

analysis of freeways and arterials; the analysis and design of traffic control systems, including signalized and unsignalized intersections. **Prerequisite:** CEGR 416 (Transportation Eng). (FALL)

CEGR 466 TRANSPORTATION MODELS AND SIMULATION *Three hours lecture; 3 credits.*

The theory, development and application of models and modeling systems commonly used in the planning, design and operational analysis of transportation systems. Students are expected to apply existing software in the analysis of transportation data sets and to develop models using one of the common high level languages. Applications will include: travel demand estimation, modal choice, terminal and servicing phenomena and traffic performance evaluation. **Prerequisites:** MATH 331 (Probability & Statistics) and CEGR 465 (Traffic Eng). (SPRING)

CEGR 467 CIVIL ENGINEERING SYSTEMS *Three hours lecture; 3 credits.* Advanced topics in the systems approach to civil engineering management. Topics and methods to include: constrained optimization; marginal analysis; linear programming; sensitivity analysis; dynamic programming; multi-objective optimization. **Prerequisite:** CEGR 400 (Project Mgt, Fin & Entrep) or equivalent. (OFFERED AS NEEDED)

CEGR 470 ENERGY EFFICIENCY IN BUILDINGS *Three hours lecture; 3 credits.* Introduction to principles of energy generation, transport and storage in building components, materials and spaces. Concepts of thermal comfort and energy conservation in buildings. Heating, cooling and air change/quality requirements. Thermal analysis and design of building envelopes. Performance and control of HVAC and other integrated building energy components. Introduction to solar - renewal energy and sustainable building design, analysis and performance assessment. **Prerequisite:** Senior standing. (OFFERED AS NEEDED)

CEGR 471 MECHANICAL AND ELECTRICAL FACILITIES *Three hours lecture; 3 credits.* Introduction to principles and applications of mechanical and electrical systems to the design, construction codes, and integration of (1) mechanical facilities, including water and waste plumbing, heating, ventilating, air-conditioning, and fire-protection, and (2) electrical facilities, including power, lighting and safety circuits and wiring, and building automation systems. **Prerequisite:** Senior standing. (OFFERED AS NEEDED)

CEGR 475 FUNDAMENTALS OF CONSTRUCTION ENGINEERING AND MANAGEMENT *Three hours lecture; 3 credits.* This course will teach the applications of the fundamentals of construction engineering and management in construction practice and provide a foundation in the important aspects of construction management and the emerging areas that will concern the construction manager in the future. **Prerequisite:** CEGR 400 (Project Mgt, Fin & Entrep) or Permission of Instructor. (FALL/SPRING)

CEGR 476 CONSTRUCTION ECONOMICS *Three hours lecture; 3 credits.* This course will teach the civil engineering, architecture, surveying, mechanical engineering, structural engineering, construction, project or estate management, property development, conservation and economics student, the basic concepts of allocation of scarce resources in construction. **Prerequisite:** CEGR 475 (Fundamentals of Construction Eng & Management) or Permission of Instructor. (FALL)

CEGR 477 FUNDAMENTALS OF CONSTRUCTION ESTIMATING *Three hours lecture; 3 credits.* This course will teach the students the process of construction cost estimating and control of construction projects. It will provide learning in cost estimating that is applicable to students taking the course while in college or while they are out of college, but have recently assumed estimating

responsibilities in a construction organization. **Prerequisite:** CEGR 475 (Fundamentals of Construction Eng & Management) or CEGR 476 (Construction Economics) or Permission of Instructor. (SPRING)

CEGR 480 FUNDAMENTALS OF GEOGRAPHIC INFORMATION SYSTEMS *Three hours lecture; 3 credits.* The course provides students with comprehensive knowledge and understanding of Geographic Information Systems (GIS) and its applications in science, technology, engineering and mathematics (STEM). It will cover GIS concepts, principles, and applications. Data acquisition, processing, management, analysis, modeling, and product generation are emphasized. Students will actively participate in data acquisition, and mapping. Training in GIS software, including ArcGIS/ArcView, GeoMedia Suite, and Pathfinder Office software will be provided during the course. Term project with oral presentation and written report will form part of this course. **Prerequisite:** None. (SPRING)

CEGR 481 FUNDAMENTALS OF REMOTE SENSING *Three hours lecture; 3 credits.* The course introduces students to sensor systems, basic concepts of Remote Sensing (RS), methodologies and applications in science. Technology, engineering and mathematics (STEM). Aerial photographs and airborne/satellite images will be processed and analyzed. NASA's Mission to Planet Earth and the Earth Observing Systems (EOS) Program will be introduced. Training in RS software, including the environment for visualizing images (ENVI) will be provided. Students will actively participate in data acquisition, ground-truthing/verification, and final product generation/mapping. Term project with oral presentation and written report will form part of this course. **Prerequisite:** None. (FALL)

CEGR 492 SENIOR REVIEW AND PROJECT PROPOSAL *One hour lecture, four hours practicum; 2 credits.* This course, typically undertaken in student's penultimate semester, has two parts: (1) Lecture (Senior Project Proposal) - during which student develops, in concert with a faculty advisor (for some projects, it is also desirable that the student select an advisor from industry, in addition to the faculty advisor), the technical proposal for the Senior Design Project, and (2) Practicum - comprehensive review of the Fundamentals of Engineering (FE) civil-discipline-specific examination topics and mock-FE examinations. A brief initial part of the practicum reviews technical report writing and presentation for engineers and development of a design project proposal. Two 4-hour mock-FE exams (simulating the A.M. and P.M. sessions of the FE exam) serve as the program's comprehensive examination, as well as an assessment of the practicum part of the course. The final grade in the course is a combination of the faculty advisor's evaluation of the student's project proposal effort and written report, and the students' performance in the mock-FE exams and other aspects of the practicum. *Civil Engineering students of at least junior standing may be allowed, with department approval, to audit the review class portion without financial obligation.* **Prerequisite:** Senior Standing, and Permission of Faculty Advisor and Department Chair. (FALL/SPRING)

CEGR 493 SENIOR PROJECT *Two hours lecture; 2 credits.* This is a follow up on the proposal developed and approved in CEGR 492, and will focus on the execution of the proposed analysis and design, under the guidance of the same faculty advisor (and external advisor, if any). Specific guidelines on the successful completion of the project should come from the student's faculty advisor. However, this second semester of the two-semester CEGR 492-493 sequence should be spent on finalizing preliminary design and analysis, as well as completion of detailed design and possible optimization, creation of a design project report of acceptable format, conclusion of student's electronic portfolio, and a formal delivery of a PowerPoint (or similar) presentation of the project to an audience of faculty, students and others. The grade for this course is based upon two components: (1) the advisor's assessment of the student's progress through the *entire* design project and the quality of the written technical report and (2) department's assessment of the student's up-to-date electronic portfolio; and assessment, by the

attending department faculty, of the content and the quality of the presentation made by the student.

Prerequisite: CEGR 492. (FALL/SPRING)

CEGR 496 SENIOR PROJECT PROPOSAL AND DESIGN *Two hours lecture, four hours practicum; 3 credits.* This is a one-semester course combining CEGR 492 Senior Review and Project Proposal, and CEGR 493 Senior Project. **Prerequisite:** Senior Standing, and Permission of Faculty Advisor and Department Chair. (OFFERED AS NEEDED)

CEGR 498 TOPICS IN CIVIL ENGINEERING *Three hours lecture; 3 credits.* In-depth study in areas of student/faculty interest. Approval of the Faculty Course Director, Faculty Advisor and Department Chair required. (FALL/SPRING)

MORGAN STATE UNIVERSITY
SCHOOL OF ENGINEERING
 CIVIL ENGINEERING
 CURRICULUM SEQUENCE

FRESHMAN YEAR (FIRST SEMESTER)

OREN 104	INTRO TO ENGINEERING	1
CEGR 107	COMPUTER AIDED ENG. GRAPHICS, ANAL & DESIGN	3
BIOL 101	INTRODUCTION TO BIOLOGY I	4
MATH 241	CALCULUS I	4
ENGL 101	FRESHMAN COMPOSITION I	3
HEED 100	HEALTHFUL LIVING	2

Total Credits / Hours **17**

FRESHMAN YEAR (SECOND SEMESTER)

CEGR 106	INTRO TO CIVIL ENGINEERING	2
CEGR 110	GEOSPATIAL TECHNOLOGIES IN CIVIL ENGINEERING	3
MATH 242	CALCULUS II	4
PHYS 205	PHYSICS I	5
ENGL 102	FRESHMAN COMPOSITION II	3
PHEC XXX	PHYSICAL EDUCATION	1

Total Credits / Hours **18**

SOPHOMORE YEAR (FIRST SEMESTER)

CEGR 202	STATICS	3
ECON 212	PRINCIPLES OF ECONOMICS II	3
PHYS 206	PHYSICS II	5
MATH 243	CALCULUS III	4
HIST 101/	WORLD HISTORY I/	
HIST 105	HISTORY OF U.S. I	3

Total Credits / Hours **18**

SOPHOMORE YEAR (SECOND SEMESTER)

CEGR 212	MECHANICS OF MAT & LAB	3
CEGR 214	FLUID MECHANICS & LAB	3
CHEM 110	GENL CHEMISTRY FOR ENG	5
MATH 340	INTRO TO DIFF EQUATIONS	3
HIST 102/	WORLD HISTORY II/	
HIST 106	HISTORY OF U.S. II	3

Total Credits / Hours **17**

JUNIOR YEAR (FIRST SEMESTER)

CEGR 324	STRUCTURAL ANAL I & LAB	3
CEGR 325	GEOTECHNICAL ENG & LAB	3
CEGR 307	COMPUTER METHODS AND PROGRAMMING FOR C.E.	3
MATH 331	PROB & STATISTICS FOR ENG	3
HUMA 201	INTRO TO HUMANITIES I	3

Total Credits / Hours **15**

JUNIOR YEAR (SECOND SEMESTER)

CEGR 436	ELEM STRUCTURAL DESIGN	3
CEGR 332	HYDRAULIC/WATER RES ENG	3
CEGR 338	ENVIRONMENTAL ENGINEERING I & LAB	3
CEGR 416	TRANSPORTATION ENG	3
HUMA 202	INTRO TO HUMANITIES II	3

Total Credits / Hours **15**

SENIOR YEAR (FIRST SEMESTER)

CEGR 492	SENIOR REVIEW AND PROJECT PROPOSAL	2
CEGR 302	DYNAMICS	3
CEGRXXX	C.E. TECHNICAL ELECTIVE ¹	3
XEGRXXX	MULT-DISP ENG ELECTIVE ²	3
PHIL 109	INTRODUCTION TO LOGIC	3

Total Credits / Hours **14**

SENIOR YEAR (SECOND SEMESTER)

CEGR 493	SENIOR PROJECT	2
CEGR 400	PROJECT MANAGEMENT, FINANCE AND ENTREP	3
CEGRXXX	C.E. TECHNICAL ELECTIVE ¹	3
HIST 350	INTRO TO AFRICAN DIASPORA	3
PHIL 220	ETHICS AND VALUES	3

Total Credits / Hours **14**

TOTAL CREDIT HOURS **128**

¹*Civil Engineering Technical Electives* may be selected from the list of courses under one or more of the indicated tracks below.

²*Multidisciplinary Engineering Elective* may be selected from the approved list of courses below.

TECHNICAL ELECTIVES

TRANSPORTATION ENGINEERING

CEGR 465	Traffic Engineering	3
CEGR 466	Transportation Models and Simulation	3
CEGR 467	Civil Engineering Systems	3
CEGR 498	Topics in Civil Engineering	3

STRUCTURAL ENGINEERING

CEGR 450	Structural Analysis II	3
CEGR 451	Design of Concrete Structures	3
CEGR 452	Design of Steel Structures	3
CEGR 453	Reliability-based Design in Civil Engineering	3
CEGR 498	Topics in Civil Engineering	3

GEOTECHNICAL ENGINEERING

CEGR 454	Foundation Engineering	3
CEGR 455	Seepage, Drainage, and Groundwater	3
CEGR 456	Earth Structures and Slopes	3
CEGR 457	Geotechnical Engineering	3
CEGR 498	Topics in Civil Engineering	3

ENVIRONMENTAL ENGINEERING

CEGR 458	Biological Wastewater Engineering	3
CEGR 459	Water Supply Engineering	3
CEGR 460	Hazardous Waste Management	3
CEGR 463	Physical-Chemical Treatment of Water and Wastewater	3
CEGR 464	Environmental Engineering II	3
CEGR 498	Topics in Civil Engineering	3

CONSTRUCTION ENGINEERING AND MANAGEMENT

CEGR 475	Fundamentals of Construction Engineering and Management	3
CEGR 476	Construction Economics	3
CEGR 477	Fundamentals of Construction Estimating	3
CEGR 471	Mechanical and Electrical Facilities	3
CEGR 498	Topics in Civil Engineering	3

CIVIL ENGINEERING SYSTEMS

CEGR 467	Civil Engineering Systems	3
CEGR 470	Energy Efficiency in Buildings	3
CEGR 471	Mechanical and Electrical Facilities	3
CEGR 480	Fundamentals of Geographic Information Systems	3
CEGR 481	Fundamentals of Remote Sensing	3
CEGR 498	Topics in Civil Engineering	3

MULTIDISCIPLINARY ENGINEERING ELECTIVE

EEGR 310	Principles of Electronics	3
IEGR 305	Thermodynamics	3
IEGR 450	Introduction to Mechatronics	3