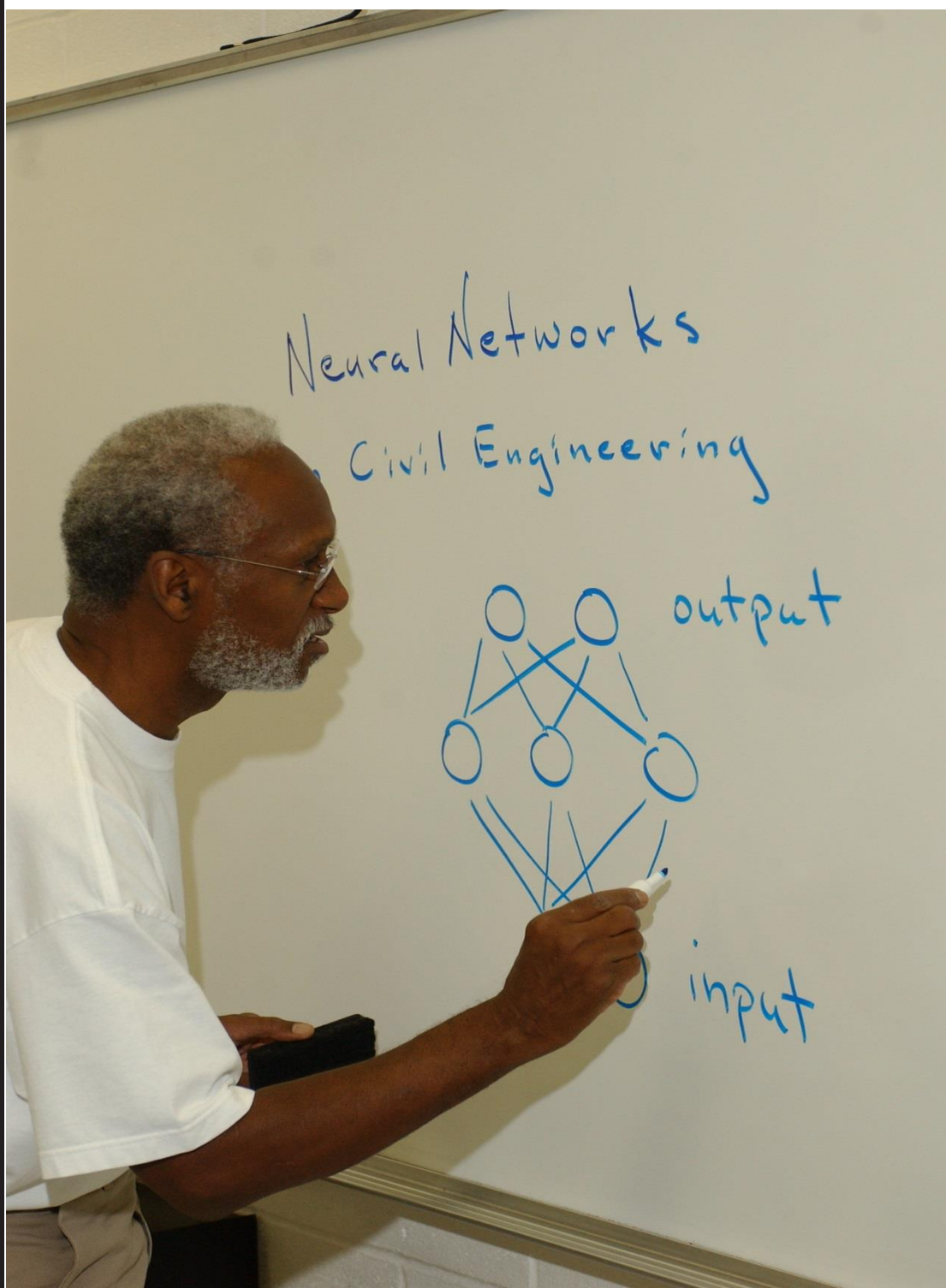
THE SCHOOL OF ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING

DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE STUDIES



SCHOOL OF ENGINEERING

Dr. Eugene M. DeLoatch, Dean
Dr. Carl White, Associate Dean, Research & Development/Graduate and Professional Programs

The School of Engineering offers educational programs which ensure that students acquire the ability to master fundamental principles of engineering which may be applied effectively to benefit society. All efforts of the faculty and administration are directed at developing the students' potential and preparing them to assume leadership roles in their chosen profession.

GOALS AND OBJECTIVES

The primary objectives of the School of Engineering are as follows:

Establish a School of Engineering of the first rank.

Instill in its students the confidence and competence required to meet the challenges associated with careers in engineering.

Produce competitive engineers who have negotiated a well-balanced curriculum based on regional and national accreditation guidelines.

Exhibit educational leadership in accomplishing the task of increasing the representation of African Americans and others who are underrepresented among engineering professionals.

The School of Engineering awards the Bachelor of Science degree in Civil Engineering, Electrical Engineering, Industrial Engineering, and Transportation Systems. All of the Engineering programs are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.

Bachelor of Science to Master of Engineering (B.S./ M.Eng)

Purpose

The purpose of the Bachelor of Science/Masters of Engineering (B.S./M.Eng.) degree program is to enable well qualified and highly motivated undergraduates students majoring in Engineering to obtain both a bachelor's and master's degree in a minimum of five years. The B.S./M.Eng. program is applicable to the Bachelor of Science (B.S.) degrees in the three engineering disciplines (Civil, Electrical & Computer, and Industrial Manufacturing Information) and the Master of Engineering (M.Eng.) degree within the Clarence M. Mitchell, Jr. School of Engineering. The goal of the B.S./M.Eng. program is to accelerate the production of engineering professionals who are capable of entering into the technology workforce and making significant contributions to society, while safeguarding the environment.

Admission Criteria

The B.S./M.Eng. program allows students to begin graduate study (concurrent with undergraduate work) in the second semester of their junior year. Students are allowed to apply for admission into the program upon completion of 85 credits. For consideration of admission into the B.S./M.Eng. program, a student must:

The application is submitted in the first instance to the graduate coordinator of the prospective engineering department. Applications determined to be eligible, following consideration by the appropriate committee of the (MSU) engineering faculty, shall be forwarded through the Office of the Associate Dean of the School of Engineering to the School of Graduate Studies.

General Requirements

All students who seek candidacy into the B.S./M.Eng. program will be required to complete the B.S. degree requirements of their respective discipline, and a total of 33 acceptable credit hours of graduate coursework inclusive of 2 credit hours of seminar and 4 credit hours of Project Report. Successful completion and oral defense of the Report Project is required in lieu of taking a comprehensive examination.

Program of Study

A core requirement of three interdisciplinary courses (9 credit hours) will be required of all students entering at the B.S./M.Eng program. These courses are carefully designed and coordinated to stress the interdisciplinary nature of the subject matter. The content serves as the philosophical foundation on which all other materials tailored for a specific student are based. The courses are as follows:

CEGR 514 Environ Impact/Risk Assessment 3 Credits
EEGR 505 Advanced Engineering Mathematics with Computational Methods 3 Credits
EGR 512 Advanced Project Management 3 Credits **Total Credit Hours 9**

Students accepted for candidacy into the B.S./M.Eng. program will begin taking these courses in the second semester of their junior year.

Eighteen credits (excluding the 2 credits of seminars and 4 credits of project reports) are directed toward building an interdisciplinary strength in a sub-discipline. Candidates will complete these courses during the fifth year.

Maintaining Eligibility
Candidates in the B.S./M.Eng. Program are expected to maintain a high level of scholastic achievement. The above constitutes the minimum requirements for consideration for admission into the program. Admitted students must maintain a minimum GPA of 3.00 to remain in good standing as required by the School of Graduate Studies. Candidates who fall below the minim- um cumulative grade point average of 3.0 for two consecutive semesters will be removed from the program.

A student may decide to opt out of the B.S./M.Eng. program; however, they must complete all requirements for the traditional B.S. degree program. The B.S./M.Eng. program curriculum is designed such that candidates who successfully complete their coursework through the end of the senior year will automatically qualify them for completion of the B.S. degree requirements. Graduate courses success- fully completed up to this time, may be applied to the tra- ditional graduate program. Once a candidate has opted out of the program, the candidate is no longer eligible for the B.S./M.Eng. program degree. In order to receive a Master's Degree at Morgan State University, the student will then have to apply to the traditional two year M.Eng. program.

Candidates who are removed from the program or otherwise opt out of the program are eligible to receive the traditional bachelor's degree in their respective engineering discipline major, on completion of the requirements for the B.S. degree.

Degrees Received
Upon completion of minimum requirements, students receive both the Bachelor of Science and the Master of Engineering degrees. The Bachelor of Science degree will be awarded from the respective departments, that is, the B.S.E.E. from the Electrical and Computer Engineering Department, the B.S.C.E. from the Civil Engineering De- partment, and the B.S.I.E from the Industrial and Systems Engineering Department. The M.Eng. degree will be awarded from the School of Graduate Studies. A student may elect to receive only a B.S. degree, but must complete the requirements for the traditional B.S. degree program.

CIVIL ENGINEERING

The following information is operable for the students who are already matriculating under the 2010-2013 catalogs, however, New students both freshman and transfers, who enroll in fall 2014 or later must follow this 2014-2015 catalog. Chairperson of Department: PROFESSOR REGINALD L. AMORY; Samuel P. Massie Chair of Excellence in the Environmental Disciplines: Professor JIANG LI; Associate Professors: IHEANYI ERONINI, MONIQUE HEAD, GBEKELOLUWA B. OGUNTIMEIN, Assistant Professors: INDRANIL GOSWAMI, JAMES HUNTER Lecturer: CHARLES O. OLUOKUN, OLLIDARE OWOLABI

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 systems, environmental and water resources, structures, geotechnical, hydrology, 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 modem engineering tools necessary for engineering practice.

REQUIREMENTS FOR THE B.S. DEGREE IN CIVIL ENGINEERING
A minimum of 120 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	**49**
Mathematics and Science Requirements	**21**
Engineering Requirements	**50**

TOTAL **120**

A. General Education and University Requirements

Courses#	Course Title	Credits
CEGR 107	Computer-Aided Engineering Graphics and Design	3
CHEM 110	General Chemistry	4
ECON 212	Principles of Economics	3
ENGL 101	Freshman Composition I	3
ENGL 102	Freshman Composition II	3
HEED 103	Health Education	2
HIST 101/105	World History I/History of the U.S. I	3 3
HIST 350	Introduction to African Diaspora	3
HUMA 201	Introduction to Humanities I	3
MATH 241	Calculus I	4
OREN 104	Introduction to Engineering	1
PHEC XXX	Physical Education Elective	1
PHIL 109	Introduction to Logic	3
PHIL 220	Ethics and Values	4
PHYS 206	General Physics	3

Total Credits 49

B. Mathematics and Science Requirements

Course #	Course Title	Credits
CEGR 307	Computer Method & Programming for Civil Engineers	2
MATH 242	Calculus II	4
MATH 243	Calculus III	4
MATH 331/ IEGR 331	Probability and Statistics	3
MATH 340	Differential Equations	3
PHYS 205	General Physics I	5

Total Credits **21**

C. Engineering Requirements

Course #	Course Title	Credits
CEGR 106	Introduction to Civil Engineering	1
CEGR 110	Geospatial Tech in Civil Eng.	2
CEGR 202	Statics	3
CEGR 212	Mechanics of Materials & Lab	3
CEGR 214	Fluid Mechanics and Lab	3
CEGR 302	Dynamics	3
CEGR 324	Structural Analysis I and Laboratory	3
CEGR 325	Geotechnical Engineering & Lab	3
CEGR 332	Hydraulic/Water Recourses and Laboratory	3
CEGR 338	Environmental Engineering I and Laboratory	3
CEGR 400	Project Management, Finance Entrepreneurship	2
CEGR 416	Transportation Engineering	3
CERG 436	Elementary Structural Design	3
CERG XXX	Civil Engineering Technical Electives	9
XEGR XXX	Multidisciplinary Engineering Elective	3
CEGR 492	Senior Review & Project Proposal	2
CEGR 493	Senior Project	1

Total Credits **50**

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 ENGINEERNG (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. (Formerly ORIE 104) (FALL/SPRING**)**

CEGR 106 INTRODUCTION TO CIVIL ENGINEERING *One hour lecture; 1 credit.* This orientation course will introduce students to the concept of engineering design by exposure to several design problems from various areas of civil engineering including: structural, transportation and environmental engineering**. Prerequisite**: OREN 104. (FALL/SPRING)

CEGR 107 COMPUTERAIDEDENGINEERING 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, two hours laboratory, 2 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 geometries, 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 11). (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:** MATH243(Calculus III). Corequisite:MATH240 (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, two hours laboratory; 2 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), MATH243 (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 Three 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. **Prerequisite:** CEGR 202 (Statics) and CEGR 212 (Mechanics of Materials & Lab). (FALL/SPRING**)**

CEGR 332 HYDRAULIC ENGINEERING *Three hours lecture; 3 credits.* Includes hydrology; open- channel flow; pipe flow; ground water flow; dams and reservoirs. Computer programming assignments are incorporated into the course work. **Prerequisites:** CEGR 214 and CEGR 307. (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), MATH 242 Calculus II (FALL/SPRING)

CEGR 400 PROJECT MANAGEMENT, FINANCE & ENTREPRENEURSHIP Two hours lecture, one hour practicum; 2 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. **Prerequisites**: 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 plan- ning for transportation facilities with emphasis on ground transportation. Topics include: vehicle motion, vehicle flow models, human factors, geometric de- sign, safety, capacity analysis and transportation planning. **Prerequisite:** ECON 211/212. (FALL/SPRING)

CEGR 436 ELEMENTARY STRUCTURAL DESIGN *Three hours lecture; 3 credits.* Introduction to design principles. Safety factors. Steel and concrete properties. Design of steel and reinforced concrete beams and columns. Design of steel connections. Design of steel trusses. **Prerequisites:** CEGR 324. (FALL/SPRING)

CEGR 450 STRUCTURAL ANALYSIS II *Three hours lecture; 3 credits.* Deflection of statically deter- minate 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. (FALL/SPRING)

CEGR 451 DESIGN OF REINFORCED CON- CRETE STRUCTURES *Three hours lecture 3 credits.* Structural properties of concrete, building codes; design of beams, columns, slabs, footings, and retaining walls. **Prerequisites:** CEGR 324 and CEGR 436. (FALL)

CEGR 452 DESIGN OF STEEL STRUCTURES *Three hours lecture; 3 credits.* Introduction to steel structures; design of tension members, beams and column connections, plate girders, continuous beams; introduction to computer-aided design. **Prerequisites:** CEGR 324 and CEGR 436. (SPRING)

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

CEGR 454 FOUNDATION ENGINEERING Three hours lecture; 3 credits. Application of the principles of soil mechanics to the design of footings, retaining walls, pile foundations, bulkheads, cofferdams, bridge piers and abutments, and underpinnings. **Prerequisite:** CEGR 325. (SPRING)

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

CEGR 456 EARTH STRUCTURES AND SLOPES Three hours lecture; 3 credits. Earth dams, embank- ments and natural slopes. Site investigation, soil proper- ties and compaction. Slope stability analysis and land- slide prevention. Earthquake effects. Case studies. **Prerequisite:**

CEGR 325. (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). (SPRING)

CEGR 458 BIOLOGICAL WASTE WATER TREEATMENT 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 WASTEWATER Three hours lecture; 3 credits. Theory and application of physical and chemical operation and processes for wastewater treatment. Topics and discussion will include sedimentation; flotation; disinfection; coagulation; flocculation; filtration; carbon absorption; reverse osmosis; ion exchange and thickening. **Prerequisite:** CEGR338. (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:** CEGR 338 (Environmental Eng. I & 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:** CEGR 465, and IEGR 331/MATH 331. (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 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; 3credits. 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/ Arc View, 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 student' 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)

CEGR 493 SENIOR PROJECT Two hours lecture; 1 credit. 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 492-493sequence 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 chairman required (FALL/SPRING)

MORGAN STATE UNIVERSITY
DEPARTMENT OF CIVIL ENGINEERING
BACHELOR OF SCIENCE DEGREE IN CIVIL ENGINEERING
SUGGESTED CURRICULUM SEQUENCE
(2014-2015)

FRESHMAN YEAR (FIRST SEMESTER)	
OREN 104 Freshman Orientation for Engineering	1
CEGR 107 – IM – Computer Aided Engineering Graphics, Analysis & Design	3
BIOL 101 – BP – Introduction to Biology I	4
MATH 241 – MQ – Calculus I	4
ENGL 101 – EC – Freshman Composition I	3
HEED 103 – HH – Healthful Living	3
	18

FRESHMAN YEAR (SECOND SEMESTER)	
CEGR 106 Introduction to Civil Engineering	1
CEGR 110 Geospatial Technologies in CE	2
MATH 242 – MQ – Calculus II	4
ENGL 102 – EC – Freshman Composition II	3
PHEC XXX Physical Education	1
PHYS 205 + PHYS 205L – BP – Univ Physics + Lab	5
	16

SOPHOMORE YEAR (FIRST SEMESTER)	
CEGR 202 Statics	3
ECON 212 – SB – Principles of Economics II	3
HIST 101 – SB – WORLD HISTORY I	
OR	3
HIST 105 – SB – HISTORY OF U.S.	
MATH 243 – MQ – Calculus III	4
PHYS 206+PHYS 206L – BP – Univ Phys II+Lab II	5
	18

SOPHOMORE YEAR (SECOND SEMESTER)	
CEGR 212 Mechanics of Materials & Lab	3
CEGR 214 Fluid Mechanics & Lab	3
CHEM 110 + CHEM110L – BP – Gen Chem for Eng	4
MATH 340 – MQ – Intro to Differential Equations	3
HUMA 201 – AH – Introduction to Humanities I	3
	16

JUNIOR YEAR (FIRST SEMESTER)	
CEGR 324 Structural Analysis I and Lab	3
CEGR 325 Geotechnical Engineering & Lab	3
CEGR 307 Computer Methods & Prog for CE	2
CEGR 416 Transportation Engineering	3
MATH 331 – MQ – Probability and Statistics	
OR	3
IEGR 251 Probability and Statistics for Eng I	
	14

JUNIOR YEAR (SECOND SEMESTER)	
CEGR 436 Elementary Structural Design	3
CEGR 332 Hydraulic/Water Resources Engineering	3
CEGR 338 Environmental Engineering & Lab	3
PHIL 220 – AH – Ethics & Values	3
	12

SENIOR YEAR (FIRST SEMESTER)	
CEGR 492 Senior Review and Project Proposal	2
CEGR 302 Dynamics	3
CEGR XXX Civil Engineering Technical Elective	3
XEGR XXX Multidisciplinary Engineering Elective	3
PHIL 109 – CI – Introduction to Logic	3
	14

SENIOR YEAR (SECOND SEMESTER)	
CEGR 493 Senior Project	1
CEGR 400 Project Management, Finance & Entrepreneurship	2
CEGR XXX Civil Engineering Technical Elective	3
CEGR XXX Civil Engineering Technical Elective	3
HIST 350 – CT – Introduction of African Diaspora	3
	12

TOTAL CREDIT HOURS **120**

(See next page for Technical Electives for suggested concentrations.)

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

ELECTRICAL AND COMPUTER ENGINEERING

Chairperson of the Department: PROFESSOR CRAIG SCOTT; Professors: ARLENE COLE-RHODES, KEVIN KORNEGAY, CARL WHITE; Associate Professors: YACOB ASTATKE, JUMOKE LADEJI-OSIAS, KOFI NYARKO, MICHEL REECE, JAMES E. WHITNEY; Assistant Professor: FARZAD MOAZZAMI; Lecturers: RICHARD DEAN, COREY DICKENS, PETRONELLA JAMES, LADAWN PARTLOW, PATERNE SISSINTO, GREGORY M. WILKINS.

THE MAJOR IN ELECTRICAL ENGINEERING

The Department of Electrical and Computer Engineering provides its students the opportunity to apply mathematical and physical concepts to engineering problems early in the curriculum, through laboratory and design experiences. The Department has been following the philosophy of design across the curriculum for some time. In addition to the strong design experience integrated throughout the required courses, the electives offer students the opportunity to enhance their skills with additional open-ended problem solving. These problems are broad-based, incorporating knowledge from specialty areas of communications systems, signal processing, microwave systems, solid state electronics, controls and automation, and computer engineering. The computer engineering emphasis is a special component of the electrical engineering (EE) program, where the Department offers a concentration in this area within its EE program. This rounds out the program by providing the necessary tools to meet the demands of the information age.

OBJECTIVES

The primary objectives of the Department are consonant with those of the School of Engineering. In striving to develop a program of the highest quality, the program seeks to instill in its students the confidence and competence required to meet the challenges associated with careers in electrical and computer engineering. The primary objectives of the Department are to develop a challenging and adaptive electrical and computer engineering curriculum which continuously fosters excellence, breadth, and depth. Within this framework the Department will produce students that will:

A. Remain effective in their employment in engineering and other professional career fields.
B. Facilitate innovation and synthesis of new products and services, as well as improve existing products, in a global context.
C. Are leaders and/or major contributors in their profession, community and other organizations.
D. Continue the learning process throughout their careers.
E. Provide service to their profession and community-at-large.

REQUIREMENTS FOR THE B.S.S.E. DEGREE

A minimum of 120 credit hours are required of students pursuing the Bachelor of Science Degree in Electrical Engineering (B.S.E.E.). These credit hours are distributed as follows:

General Education and University Requirements	45
Mathematics and Science Requirements	19
Electrical Engineering Core Requirements	38
Electives or Concentration Requirements	18
TOTAL	**120**

Students must complete all of the requirements in sections A, B, C and D or sections A, B, C and E.

A. General Education and University Requirements

Course #	***Course Title***	***Credit***
EEGR 161	Intro to C Programming (IM)	3
ENGL 101	Freshman Composition I	3
ENGL 102	Freshman Composition II	3
PHIL 109	Introduction to Logic	3
MATH 241	Calculus I	4
Approved Arts and Humanities courses		6
CHEM 110	General Chemistry for Engineers	4
PHYS 205	University Physics I + Lab	5
Approved Social and Behavioral Science courses		6
Approved Health and Healthful Living course		3
HIST 350	Introduction to African Diaspora	3
OREN 104	Introduction to Engineering	1
PHEC XXX	Physical Education Elective	1
TOTAL		**45**

B. Math and Basic Sciences Requirements

Course #	***Course Title***	***Credit***
MATH 242	Calculus II	4
MATH 243	Calculus III	4
MATH 340	Differential Equations	3
MATH 331	Applied Probability and Statistics	3
PHYS 206	University Physics II + Lab	5
TOTAL		**19**

C. Engineering Core Requirements

Course #	**Course Title**	**Credit**
EEGR 105	Introduction to Elect. & Comp. Engr.	3
EEGR 202	Electric Circuits	4
EEGR 203	Introduction to Electrical Laboratory	1
EEGR 211	Introduction to Digital Logic	3

EEGR 215	Electronic Materials & Devices	4
EEGR 221	Signals and Systems	4
EEGR 305	Electromagnetic Theory & Applications	4
EEGR 317	Electronic Circuits	4
EEGR 322	Discrete Systems	3
EEGR 390	Principles of Design	3
EEGR 400	Introduction to Professional Practice	1
EEGR 490	Senior Design Project I	2
EEGR 491	Senior Design Project II	2
TOTAL		**38**

D. Electrical Engineering Electives Requirements (12 credits)

EEGR 4XX	ECE Electives (4)	12
XXXX XXX[2]	Approved Elective	6
TOTAL		**18**

[2]Approved electives are advanced courses listed in the Physics, Chemistry, Biology, Mathematics, Computer Science, Industrial and Civil Engineering, Business programs, or other relevant courses deemed appropriate for the student's program of study. **Faculty advisor and Department Chair written approval must be obtained prior to registration.**

E. Electrical Engineering-Computer Engineering Track Requirements (12 credits)

Course #	Course Title	Credit
EEGR 243	Computer Architecture	3
EEGR 463	Digital Electronics	3
EEGR 4XX[3]	ECE Electives (2)	6
XXXX XXX[2]	Approved Elective	6
TOTAL		**18**

[1]May be replaced by EEGR 331, Probability and Random Processes for Engineers or IEGR 331, Probability and Statistics for Engineers.

[3]**Two EEGR electives** must be selected from the following: EEGR 409, EEGR 412, EEGR 417, EEGR 419, and EEGR 451. In addition, EEGR-498, EEGR-499 and Engineering Graduate offerings that relate to Computer Engineering and IEGR and COSC electives will be considered on a case by case basis. **ECE Department written approval is required prior to registering for any of these offerings outside of the EEGR listings**.

[4] Computer literacy course as required by the major/discipline.

ELECTRICAL AND COMPUTER ENGINEERING COURSE OFFERINGS

OREN 104 INTRODUCTION TO ENGINEERNG (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 expectation 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).

EEGR 105 INTRODUCTION TO ELECTRICAL AND COMPUTER ENGINEERING Three hour lecture; One hour lab. 3 credits. Introduction to the profession. Ethics and professional behavior. Students are exposed to various specialties and areas which may include an introduction to the computer, programming and computational tools; digital design; communications; laboratory instrumentation; introduction to probability and statistics and other general topics. **Prerequisites:** OREN 104 and MATH 106. Students must pass each class with a grade of "C" or better.

EEGR 161 INTRODUCTION TO C PROGRAMMING *Three hours lecture; 3* credits. Topics include computer components, algorithm design with flowcharts and pseudo-code; algorithm implementation in the C programming language. Students will apply programming, documentation, debugging/ testing techniques to problem solving and data analysis. The course will include the selection and application of library programs and routines with application to engineering. **Prerequisite:** MATH 113. (FALL). Students must pass MATH 113 with a grade of "C" or better.

EEGR 202 ELECTRIC CIRCUITS Four hours lecture; 4 credits. Includes Ohm's and Kirchhoff's laws; VI laws of RLC elements, Analysis techniques including Thevenin's and Norton's Theorem; Phasor concepts, Two-port and magnetically coupled networks. **Prerequisites:** MATH 242 and PHYS 205 MATH 340 and PHYS 206. **Co-requisites:** MATH 340 and PHYS 206. (FALL/SPRING). Students must pass each class with a grade of "C" or better.

EEGR 203 INTRODUCTION TO ELECTRICAL LABORATORY One hour lecture, three hours laboratory; 1 credit. Involves report writing and the use of laboratory instruments and experiments relative to

SCHOOL OF ENGINEERING

Kirchhoff's laws, circuit linearity, transient response, and operational amplifiers. **Prerequisites:** PHYS 205 and EEGR 202. **Co-requisite:** EEGR 202. (FALL/SPRING). Students must pass each class with a grade of "C" or better.

EEGR 211 INTRODUCTION TO DIGITAL LOGIC T*hree* hours lecture, one hour laboratory; 3 credits. Covers number systems, Boolean algebra, logic functions and gates, minimization techniques, decoders, encoders, multiplexers, arithmetic circuits, latches, flip-flops, counters, and shift registers. Laboratory section includes design and implementation of combinatorial and sequential circuits. **Prerequisites:** EEGR 202, EEGR 203, and EEGR 161. (FALL/SPRING). Students must pass each class with a grade of "C" or better.

EEGR 215 ELECTRONIC MATERIALS AND DEVICES *Four* hours lecture, one hour laboratory; 4 credits. Includes semiconductor physics, PN-junction transistors, junction field effect transistors, metal oxide FETs. Laboratory consists of experiments related to the analysis and design of circuits employing diodes, transistors and integrated circuits. **Prerequisites:** EEGR 202 and EEGR 203. (FALL/SPRING). Students must pass each class with a grade of "C" or better.

EEGR 221 SIGNALS AND SYSTEMS Four hours lecture; 4 credits. Includes manipulation of continuous signals; singularity functions, differential equations and continuous convolution; Fourier series and transforms; Complex frequency; Laplace transform, state variables; Frequency analysis. **Prerequisites:** MATH 340 and EEGR 202. (FALL/SPRING). Students must pass each class with a grade of "C" or better.

EEGR 243 COMPUTER ARCHITECTURE Three hours lecture, one hour laboratory; 3 credits. Examines the basic principles and techniques used in the design and evaluation of computer systems. Includes assembly language programming techniques, data path and control design of computers, and computer performance relative to computer design. Stresses the principle design concepts that are embodied in modern computer architectures. **Prerequisites:** EEGR 203, EEGR 202, EEGR 211, and EEGR 161 (or COSC 230). (FALL/SPRING). Students must pass each class with a grade of "C" or better.

EEGR 305 ELECTROMAGNETIC THEORY AND APPLICATIONS Four hours lecture; 4 credits. This course introduces the student to the principles and applications of electromagnetics. Topics include: review of vector calculus, electric and magnetic fields, Maxwell's equations in integral and differential form, Poisson's equation, Laplace's equation, uniform plane waves, transmission lines and waveguides. **Prerequisites:** MATH 243, PHYS 206 and EEGR 202. (FALL/SPRING). Students must pass each class with a grade of "C" or better.

EEGR 310 PRINCIPLES OF ELECTRONICS Three hours lecture; 3 credits. Presents the fundamental principles of electronic devices, circuits, and digital systems. **Closed to Electrical Engineering Majors. Prerequisites:** MATH 340 and PHYS 206. (FALL/ SPRING). Students must pass each class with a grade of "C" or better.

EEGR 317 ELECTRONIC CIRCUITS *Four* hours lecture, one hour laboratory; 4 credits. Analysis and de sign of electronic circuits employing diodes and active components such as Bipolar Transistors, FETs and Op-Amps. Includes an applications-oriented design laboratory. **Prerequisite:** EEGR 215. (FALL/SPRING). Students must pass EEGR 215 with a grade of "C" or better.

EEGR 322 DISCRETE SYSTEMS Three hours lecture; 3 credits. Manipulation of discrete signals, Fourier analysis of discrete signals, z-transform, Discrete Fourier Transform, Fast Fourier Transform, Digital filter design, state variables. **Prerequisite:** EEGR 221. (FALL/ SPRING). Students must pass EEGR 221 with a grade of "C" or better.

EEGR 331 PROBABILITY AND RANDOM PROCESSES FOR ELECTRICAL ENGINEERS Three hours lecture; 3 credits. Topics covered include sample spaces, combinatorial methods, probabilities, random variables, discrete and continuous distributions, specific probability laws and their interpretation, introduction to random processes, practical EE examples and applications. **Prerequisites:** MATH 242 and EEGR 202. (OFFERED AS NEEDED). Students must pass each class with a grade of "C" or better.

EEGR 390 PRINCIPLES OF DESIGN Three hours lecture, three hours laboratory; 3 credits. Applies design principles and methods to analog and digital circuits. Students work in teams to design small systems. **Prerequisites:** EEGR 211, EEGR 221 and EEGR 317. (FALL/ SPRING). Students must pass each class with a grade of "C" or better.

EEGR 400 INTRODUCTION TO PROFESSIONAL PRACTICE One hour lecture; 1 credit. Discusses the role of the engineer in the larger world, professional ethics and behavior, and techniques for a rewarding career and life, emphasizing lifelong learning. **Prerequisites:** EEGR 211, EEGR 221, and EEGR 317. **This course is offered only for graduating seniors in the next to last semester of**

enrollment. (FALL/SPRING). Students must pass each class with a grade of "C" or better.

EEGR 409 C PROGRAMMING APPLICATIONS Three hours lecture, *one hour* laboratory; 3 credits. Data types, operators and expressions, structures, pointers, arrays and complex data structures. Program documentation, development tools and administration of large software development. **Prerequisites:** EEGR 211, EEGR 215, and EEGR 161 (or its equivalent). (FALL/SPRING). Students must pass each class with a grade of "C" or better.

EEGR 412 COMPUTER ORGANIZATION Three hours lecture, two hours laboratory; 3 credits. Consists of computer organization, machine and assembly language programming techniques, interfacing, schema, microprogramming concepts, advanced systems utilization, and project design. **Prerequisites:** EEGR 211 and EEGR 243. (OFFERED AS NEEDED). Students must pass each class with a grade of "C" or better.

EEGR 417 MICROPROCESSORS APPLICATIONS Three hours lecture, *one hour* laboratory; 3 credits. Provides an overview of microprocessors and peripherals. Teaches use of basic tools and confidence to evaluate the suitability of microcomputer technology applied to engineering problems and to effectively design microcomputer software and hardware to satisfy a variety of needs. **Prerequisites:** EEGR 211 and EEGR 243. (SPRING). Students must pass each class with a grade of "C" or better.

EEGR 418 INTRODUCTION TO NEURAL NETWORKS AND FUZZY LOGIC Three hours lecture, *one hour* laboratory; 3 credits. The course is designed to introduce students to the theory of neural networks and fuzzy logic. Students will simulate the operation of the various types of neural networks and fuzzy logic schemes on the computer. **Prerequisite:** EEGR 409. (OFFERED AS NEEDED) Students must pass EEGR 409 with a grade of "C" or better.

EEGR 419 INSTRUMENTATION CONTROL AND SENSORS Three hours lecture, *one hour* laboratory; 3 credits. Design of processor based systems to interface with real world peripherals for control and measurement and data acquisition. Includes interfacing of inputs, output drivers, isolation, digital to analog, and analog to digital conversion and such protocols as the Philips 12C, Motorola SPI, Dallas 1-wire and asynchronous serial RS232. **Prerequisites:** EEGR 409 and EEGR 317. (FALL). Students must pass each class with a grade of "C" or better.

EEGR 424 ELEMENTS OF POWER SYSTEM ANALYSIS Three hours lecture; 3 credits. Treats system network equations, load flow computations, and symmetrical and asymmetrical faults. Swing equation. **Prerequisite:** EEGR 202. (OFFERED AS NEEDED). Students must pass EEGR 202 with a grade of "C" or better.

EEGR 431 LINEAR CONTROL SYSTEMS Three hours lecture; 3 credits. Analysis of time and frequency response of closed loop systems, Routh-Hurwitz and Nyquist criteria for stability, root-locus method, and system specifications. **Prerequisite:** EEGR 221. Students must pass each class with a grade of "C" or better.

EEGR 440 INDUSTRIAL EXPERIENCE *Nine* hours; 3 *credits*. Credit awarded based on faculty evaluation of work performed by students in the Cooperative Education Program. Departmental approval before registration.

EEGR 443 INTRODUCTION TO MICROWAVES Three hours lecture; 3 credits. Deals with wave types, transmission lines and waveguides. Smith chart, S-parameters, active and passive components, and measurement techniques: **Prerequisite:** EEGR 305. **Co-requisite:** EEGR305 (FALL). Students must pass each class with a grade of "C" or better.

EEGR 444 SPECIALIZED TOPICS IN MICROWAVES Three hours lecture; 3 credits. Specialized topics and design relating to high frequency devices, circuits and systems. **Prerequisite:** EEGR 443. (SPRING). Students must pass EEGR 443 with a grade of "C" or better.

EEGR 451 DIGITAL SIGNAL PROCESSING Three hours lecture; two hours laboratory; 3 credits. Covers discrete Fourier Transform, Fast Fourier Transform, Sampling, Quantization, Digital filter design. Emphasis is placed on the applications of digital signal processing. **Prerequisite:** EEGR 322. (SPRING). Students must pass EEGR 322 with a grade of "C" or better.

EEGR 453 COMMUNICATIONS THEORY Three hours lecture; 3 credits. Includes probability theory, analog and digital modulation techniques, noise in modulating systems, digital data transmission, optimum receivers. **Prerequisite:** EEGR 322. (FALL). Students must pass EEGR 322 with a grade of "C" or better.

EEGR 454 COMMUNICATIONS ELECTRONICS Three hours lecture, *one hour* laboratory; 3 credits. Covers spectrum and noise measurements, design of AM and ASK detectors, FM and FSK modulators, and phase lock loops.

Prerequisites: EEGR 317 and EEGR 453. (OFFERED AS NEEDED). Students must pass each class with a grade of "C" or better.

EEGR 460 ELECTRO-OPTICS Three hours lecture; 3 credits. The study of Geometrical optics which includes light rays, plane and spherical surfaces, thin and thick lenses, effects of stops, ray tracing and lens aberrations; physical optics which includes lightwaves, superposition of waves, interferences of two light beams. Frauhofer diffraction by a single opening, double slits; and diffraction grading and coherent optics which discuss the diffraction theory and lensless holography. **Prerequisites:** EEGR 305 and EEGR 317. (OFFERED AS NEEDED). Students must pass each class with a grade of "C" or better.

EEGR 461 SOLID STATE ELECTRONICS I Three hours lecture, *one hour* laboratory; 3 credits. Treats semi conductor properties, valence bands, energy bands, equilibrium distribution of electrons and non-equilibrium transport of charges. **Prerequisite:** EEGR 215. (OFFERED AS NEEDED). Students must pass EEGR 215 with a grade of "C" or better.

EEGR 462 SOLID STATE ELECTRONICS II Three hours lecture, *one hour* laboratory; 3 credits. Examines the theory and analysis of basic semiconductor building block devices. These structures include: PN junctions, metal-semiconductor diodes, MOSFETs, bipolar junction transistors, and metal-semiconductor field effect transistors. **Prerequisite:** EEGR 461. (OFFERED AS NEEDED). Students must pass EEGR 461 with a grade of "C" or better.

EEGR 463 DIGITAL ELECTRONICS Three hours lecture; 3 credits. Deals with the analysis, design, simulation, and applications of digital micro-electronic systems. These include TTL, CMOS, and ECL logic families, A/D and D/A converters, semiconductor memory devices such as RAM, ROM, EPROM, EEPROM, and programmable logic devices. Design projects are an integral part of this course. **Prerequisites:** EEGR 211 and EEGR 317. (SPRING). Students must pass each class with a grade of "C" or better.

EEGR 465 PHYSICAL ELECTRONICS Three hours lecture, two hours laboratory; 3 credits. Analysis of semiconductor device characteristics. Includes homojunction and heterojunction materials, MESFET devices, HEMT FETs, heterojunction bipolar transistors and quantum well structures. **Prerequisite:** EEGR 317. (OFFERED AS NEEDED). Students must pass EEGR 317 with a grade of "C" or better.

EEGR 471 DESIGN OF INTEGRATED CIRCUITS Three hours lecture, *one hour* laboratory; 3 credits. Includes microelectronic circuit design and silicon integrated device characteristics and fabrication. **Prerequisite:** EEGR 317. (OFFERED AS NEEDED). Students must pass EEGR 317 with a grade of "C" or better.

EEGR480 INTRODUCTION TO CYBER SECURITY Three hours lecture; 3 credits. This course will provide a basic introduction to of all aspects of cyber-security including business, policy and procedures, communications security, network security, security management, legal issues, political issues, and technical issues. This serves as the introduction to the cyber security program. **Prerequisite:** EEGR 317. Students must pass EEGR 317 with a grade of "C" or better.

EEGR481 INTRODUCTION TO NETWORK SECURITY Three hours lecture; 3 credits. This course will provide the basic concepts in the many aspects of security associated with today's modern computer networks including local area networks and the internet. It includes the fundamentals of network architecture, vulnerabilities, and security mechanisms including firewalls, guards, intrusion detection, access control, malware scanners and biometrics. **Prerequisite:** EEGR 317. Students must pass EEGR 317 with a grade of "C" or better.

EEGR482 INTRODUCTION TO CRYPTOGRAPHY Three hours lecture; 3 credits. This course will provide practical knowledge on a wide range of cryptography mechanisms and will explore their relationship with today's modern communications and networks. It includes the fundamentals of cryptography, classic and modern encryption, decryption, public and private key structures, digital signature and secure hash functions. **Prerequisite:** EEGR 317. Students must pass EEGR 317 with a grade of "C" or better.

EEGR483 INTRODUCTION TO SECURITY MANAGEMENT Three hours lecture; 3 credits. This course will provide a basic background in the many aspects of security management associated with today's modern communications and networks. It includes the fundamentals of Risk Analysis, Risk Management, Security Policy, Security Operations, Legal issues, Business issues and Secure Systems Development. **Prerequisite:** EEGR 317. Students must pass EEGR 317 with a grade of "C" or better.

EEGR 487 TELECOMMUNICATIONS Three hours lecture; 3 credits. Consists of telecommunications systems design for point-to-point and mass data distribution, modulation techniques, propagation modes, and control methods. **Prerequisite:** EEGR 453. (OFFERED AS NEEDED). Students must pass EEGR 453 with a grade of "C" or better.

EEGR 489 CELLULAR WIRELESS COMMUNCATIONS Three hours lecture; 3 credits. Includes the basic concepts of wireless and RF systems; global system for mobile communications (GSM); code division multiple access (CDMA); and GPRS data protocols. **Prerequisites:** EEGR 322. (OFFERED AS NEEDED). Students must pass EEGR 322 with a grade of "C" or better.

EEGR 490 SENIOR DESIGN PROJECT I *F*ive hours*; 2* credits. This is the first part of a two-part sequence capstone design project. In the first part, students will select their project advisor and develop a written proposal for their major design, which indicates how the design will be executed. Students will also learn project planning and the design cycle, and consider engineering standards as the proposal is developed. This is a practicum where the minimum level of effort required is five hours per credit. A copy of the proposal, with appropriate signatures, must be submitted to the Department. **Prerequisites:** EEGR 317 and EEGR 390; **Co-requisite:** EEGR 390. **This course is offered only for graduating seniors in the next to last semester of enrollment. Department approval required.** (FALL/SPRING). Students must pass each class with a grade of "C" or better.

EEGR 491 SENIOR DESIGN PROJECT II *T*en *hours; 2* credits. This is the second part of a two-part sequence capstone design project. Individual or team design, development, and analyzing of projects. Students are required to present their work in an open forum to faculty, peers and invited guests. A final technical report is required which professionally documents the design project. A copy of the report, with appropriate signatures, must be submitted to the Department office.

EEGR 498 INDEPENDENT PROJECT T*wo* hour*s* lecture, three hours laboratory; 3 credits. Individual student study performed under faculty supervision. The level of effort and subject matter must be equivalent to a 400 level Department course. **Prerequisite:** Departmental approval before registration required. (OFFERED AS NEEDED).

EEGR 499 SPECIAL TOPICS IN ELECTRICAL ENGINEERING Three hours lecture; 3 credits. Special courses not offered on a regular basis. **Prerequisite:** Departmental approval before registration. (OFFERED AS NEEDED).

CURRICULUM COURSE SEQUENCE

FRESHMAN YEAR (FIRST SEMESTER)

MATH 241	CALCULUS I	4
ENGL 101	FRESHMAN COMPOSITION I	3
HIST 101/105	HISTORY I	3
OREN 104	INTRO TO ENGINEERING I	1
HEED 103	HEALTH SCIENCE	3
		14

FRESHMAN YEAR (SECOND SEMESTER)

PHYS 205+L	PHYSICS I	5
MATH 242	CALCULUS II	4
ENGL 102	FRESHMAN COMPOSITION II	3
EEGR 105	INTRO TO ELECT & COMP ENGR	3
		15

SOPHOMORE YEAR (FIRST SEMESTER)

PHYS 206	GENERAL PHYSICS II + LAB	5
MATH 340	DIFFERENTIAL EQUATIONS	3
EEGR 202	ELECTRIC CIRCUITS	4
EEGR 203	INTRO TO ELECTRICAL LAB	1
EEGR 161[4]	INTRO TO C PROGRAMMING	3
		16

SOPHOMORE YEAR (SECOND SEMESTER)

MATH 243	CALCULUS III	4
EEGR 221	SIGNALS & SYSTEMS	4
EEGR 215	ELEC MATERIALS& DEVICES	4
SBXXX[1]	SOCIAL AND BEHAVIORAL	3
EEGR 211	INTRO TO DIGITAL LOGIC	3
		18

JUNIOR YEAR (FIRST SEMESTER)

EEGR 305	ELECTROMAGNETICS	4
EEGR 322	DISCRETE SYSTEMS	3
EEGR 317	ELECTRONIC CIRCUITS	4
HUMA 201	INTRO TO HUMANITIES I	3
		14

JUNIOR YEAR (SECOND SEMESTER)

MATH 331	APPLIED PROB & STATS	3
EEGR 390	PRINCIPLES OF DESIGN	3
XXX XXX[3]	APPROVED NON EE ELECTIVE/	3
EEGR 4XX[2]	ECE ELECTIVE	3
PHIL 109	INTRO TO LOGIC	3
		15

SENIOR YEAR (FIRST SEMESTER)

EEGR 490	SR. DESIGN PROJECT I	2
EEGR 400	INTRO TO PROFESSIONAL PRACTICE	1
EEGR 4XX[2]	ECE ELECTIVE	3
EEGR 4XX[2]	ECE ELECTIVE	3
AHXXX[1]	ARTS AND HUMANITIES ELEC	3
CHEM110	GENERAL CHEMISTRY FOR ENIGINEERS	4
		16

SENIOR YEAR (SECOND SEMESTER)

EEGR 491	SR. DESIGN PROJECT II	2
EEGR 4XX[2]	ECE ELECTIVE	3
HIST 350	INTRO TO AFR DIASPORA	3
XXX XXX[3]	APPROVED NON EE ELECTIVE	3
PHEC XXX	PHYSICAL EDUCATION	1
		12

Total 120 Credits

[1] See section A for approved replacement course.
[2] See sections D and E for approval specification. EEGR 243 is required for the computer engineering track.
[3] See sections D and E for approved electives.
[4] Computer literacy course as required by the major/discipline (IM)

INDUSTRIAL AND SYSTEMS ENGINEERING

Chairperson of the Department: TRIDIP K. BARDHAN; Professor: SEONG W. LEE, GUANGMING CHEN; Associate Professor: RICHARD A. PITTS, Jr., LEEROY BRONNER; Assistant Professor: BHEEM KATTEL; Lecturers: MASUD SALIMIAN.

THE INDUSTRIAL ENGINEERING PROGRAM

The Industrial Engineering Program provides students with the knowledge, skills and tools to design and improve processes, and apply the basic factors of production (people, machines, materials, information, and energy) to make products and deliver goods and services. The program seeks to provide students with a broad array of talents and experiences that would enable them to work in multi-disciplinary and diverse teams to solve a wide variety of problems. At the same time, the program allows for some focus in a concentration area, such as engineering management, manufacturing systems, information and systems engineering, and ergonomics and human factors.

Our Industrial Engineering Program is currently accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org. This is the only accredited Industrial Engineering program in the state of Maryland.

Because industrial production is a critical part of national prosperity and strength, today's industrial engineers are expected to be creative in problem solving, and to work with new and improved production machinery, robots and automation systems, computers, and in general, new technology, to produce high quality goods and services at low cost and/or for the maximum benefit to society.

The technical, socio-economic and cultural nature of industrial engineering problems requires the industrial engineer to be highly skilled in the basic sciences, computers, engineering, and analytical methods, and to have a broad training that encompasses the behavioral sciences, economics and management, human relations, as well as consciousness of the environment.

OBJECTIVES

The objectives of the ISE department are to prepare future leaders in Industrial Engineering with the knowledge, skills, and tools:

1. To prepare students to apply an exemplary foundation in the basic sciences, computer technology and engineering methods to solving industrial as well as manufacturing engineering problems.

2. To provide students with the skills to perform industrial engineering design, product design, and analysis, using traditional methods of mechanical, energy and manufacturing engineering.

3. To prepare and train students to work in multi-disciplinary and diverse teams to solve a wide variety of both technical and non-technical problems.

4. To educate students in methods and skills that incorporate proven techniques in human engineering and ergonomics in developing engineering solutions.

5. To prepare students to apply new tools and techniques of computer and information technology to the solution of industrial engineering as well as manufacturing engineering problems.

6. To prepare students to readily communicate complex technical information to a wide variety of audiences in both written and oral form.

7. To provide students with tools to continue their professional development and life-long learning.

REQUIREMENTS FOR THE B.S. DEGREE IN INDUSTRIAL ENGINEERING

All students pursuing the Bachelor of Science degree in Industrial Engineering (BSIE) are required to have earned a minimum of **120** academic credit hours or equivalent, at the completion of their program of study in the Industrial and Systems Engineering (ISE) Department. The minimum required credit-hour breakdown is as follows:

Category	***Credits***
General Education & University Requirements	45
Science and Mathematics Requirements	21
Industrial Engineering Core Requirements	42
IE Elective and Concentration Requirements	12
TOTAL **120**	

Students must complete all of the requirements in the sections: A, B, C, and D.

A. GENERAL EDUCATION AND UNIVERSITY REQUIREMENTS

Course #	**Course Title**	**Credit**
CHEM 110	General Chemistry for Engineering	4
ECON 211[1]	Principles of Economics	3
ENGL 101	Freshman Composition I	3
ENGL 102	Freshman Composition II	3
LANG 102[2]	Foreign Language 102 or Higher	3
HEED 103[3]	Health Science: H&S Determinants	3
HIST 350	Intro to African Diaspora	3
HUMA 201[2]	Introduction to Humanities I	3
IEGR 304	Intro to Programming for IE	3
MATH 241	Calculus I	4
ORIE 104	Introduction to Engineering	1
PHEC xxx	Physical Education	1
PHIL 109	Introduction to Logic	3
PHYS 205	University Physics I	5
PSYC 101[1]	General Psychology	3
TOTAL	**45**	

B. SCIENCE AND MATHEMATICS REQUIREMENTS

Course #	Course Title	Credit
IEGR 251	Probability & Statistics for Eng - I	3
IEGR 305	Thermodynamics	3
IEGR 361	Intro to Linear Programming	3
MATH 242	Calculus II	4
MATH 340	Differential Equation	3
PHYS 206	University Physics II	5
TOTAL	**21**	

C. INDUSTRIAL ENGINEERING CORE REQUIREMENTS

Course #	Course Title	Credit
IEGR 204	Intro to IE and Computers	2
IEGR 309	Materials Engineering	3
IEGR 317	Solid Modeling and Design – I	3
IEGR 350	Engineering Economy	3
IEGR 351	Probability & Statistics for Eng - II	3
IEGR 360	Ergonomics & Workplace Design	3
IEGR 363	Manufacturing Process	3
IEGR 367	Production & Operations Mgmt	3
IEGR 410	Simulation of Industrial Systems	3
IEGR 451	Design of Experiment & QC	3
IEGR 461	OR, Deterministic Model	3
IEGR 467	Prod Anal & Manufacturing Sys	4
IEGR 480	Product Design	3
IEGR 496[4]	Senior Design - I	1
IEGR 498[4]	Senior Design - II	2
TOTAL	**42**	

D. INDUSTRIAL ENGINEERING ELECTIVE AND CONCENTRATION REQUIREMENTS

Course #	Course Title	Credit
IEGR 4XX[5]	ISE Electives (3)	9
XXXX xxx[6]	Approved Elective	3
TOTAL	**12**	

[1]May be substituted by any approved Social and Behavioral Science Electives.

[2]May be substituted by any approved Arts and Humanities Electives.

[3]May be substituted by any approved Health and Healthful Living Electives.

[4]Consent of project advisor(s) and approval of department chair are required prior to registration.

[5]**Atleast one IEGR elective** must be selected from one of the following: IEGR 402, IEGR 404, and IEGR 455. In addition, all selected courses must be from the approved Industrial Engineering Concentration Elective courses.

[6]Approved electives are advanced courses listed in the Physics, Chemistry, Biology, Mathematics, Computer Science, Business programs, Civil and Electrical Engineering, or other relevant courses deemed appropriate for the student's program of study. **Prior to registration, written approval must be obtained from Faculty advisor and Department Chair.**

INDUSTRIAL AND SYSTEMS ENGINEE-RING COURSE OFFERINGS

OREN 104: INTRODUCTION TO ENGINEERNG -*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 expectation 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. ***Prerequisite:*** *Engineering Major.*
(FALL/SPRING)

IEGR 204: INTRODUCTION TO IE AND COMPUTERS -*Three hours lecture and laboratory; 2 credits*. This course introduces students to the basics of computer usage for engineering problem solving. Topics include: computer internal representation, computer mathematics, Microsoft Office Applications (including Word, Excel, PowerPoint, OneNote and Access), and computer-aided design (CAD). In addition, the course includes an introduction to industrial engineering (IE) as a career, an overview of the IE curriculum at Morgan State University, and an introduction to IE research.
Prerequisite: *Engineering Major.* **(SPRING)**

IEGR 251: PROBABILITY AND STATISTICS FOR ENGINEERS-I - Three hours lecture and laboratory; 3 credits. This course includes introduction to statistics and data analysis, importance of probability and statistics to engineers, Descriptive statistics, inferential statistics, introduction to probability, probability laws, Discrete and Continuous Random variables and probability distributions, and Mathematical expectations. Prerequisite: MATH 241. Student must pass MATH 241 with a grade of "C" or better. (FALL)

IEGR 304: INTRODUCTION TO PROGRAMMING FOR IE - Five hours lecture and laboratory; 3 credits.
This course introduces students to computer-based problem solving and program development fundamentals through the use of current computer/robot programming environments. Emphasis is placed on developing applications which utilize STEM principles and completing a final project which allows students to work in teams to solve a medium-sized, STEM related problem.
Prerequisite: IEGR 204. Student must pass IEGR 204 with a grade of "C" or better. (FALL/SPRING)

IEGR 305: THERMODYNAMICS - Three hours lecture and laboratory; 3 credits. Fundamental thermodynamic concepts, zeroth law of thermodynamics and temperature measurements; work and heat; First law of thermodynamics; properties of pure substances; First Law analysis of some thermodynamic systems; and power and refrigeration systems. Prerequisites: PHYS 206 and MATH 242. Student must pass PHYS 206 and MATH 242 with a grade of "C" or

better. (FALL/SPRING)

IEGR 309: MATERIALS ENGINEERING - Five hours lecture and laboratory; 3 credits. Fundamentals of materials including the structure of metals, mechanical behavior, testing, manufacturing properties, and physical properties. Metal alloys including their structure and strengthening by heat treatment. Production, general properties, and use of steels, nonferrous metals, polymers, ceramics, graphite, diamond, and composite materials.
Prerequisites: CHEM 110. Student must pass CHEM 110 with a grade of "C" or better. Co-requisite: PHYS 205. (SPRING)

IEGR 317: SOLID MODELING AND DESIGN - Five hours lecture and laboratory; 3 Credits. Introduction to solid modeling and computer-aided design for manufacturing. Students will be exposed to the rudiments of CAD and CAE, and to their applications in the design of products. Extensive discussions on modeling and design to equip students with state-of-the-art tools for product and systems design. Prerequisite: IEGR 204. Student must pass IEGR 204 with a grade of "C" or better. Co-requisite: MATH 241. (FALL/SPRING)

IEGR 335 / SEGR 335: INTRO. TO SYSTEMS ENGINEERING AND ANALYSIS - Three hours lecture and laboratory; 3 Credits. Introduction to systems engineering concepts. Systems structure, open-loop and closed-loop systems, positive and negative feedback. Applications to production and inventory systems, population and physical systems. Analytical foundation of systems engineering, calculus of finite differences, Fourier analysis, and use of transform techniques in linear systems analysis. Prerequisites: Math 242 and Junior Standing. Student must pass MATH 242 with a grade of "C" or better. (FALL)

IEGR 350: ENGINEERING ECONOMY - Three hours lecture; 3 credits. Introduces economic analysis from an engineering and personal finance perspective involving cost concepts (i.e., total revenue, optimal demand, and maximum profit); the time value of money concept with equivalence involving present, future, and uniform series cash flows; evaluation of single and mutually exclusive alternative projects/products utilizing present worth, future worth, annual worth, internal rate of return, and payback methods; and depreciation and income tax analyses. Prerequisites: IEGR 204 and MATH 241. Student must pass IEGE 204 and MATH 241 with a grade of "C" or better. (FALL/SPRING)

IEGR 351: PROBABILITY AND STATISTICS FOR ENGINEERS-II - Three hours lecture; 3 Credits. Includes Concept of Random Variables, Discrete Probability Distributions, Continuous Probability Distributions, Point Estimation, One and Two Sample Hypothesis Testing, Analysis of Variance, Completely Randomized Experiments, Randomized Complete Block Experiments, and Regression Analysis. Prerequisite: IEGR 251 and MATH 242. Student must pass IEGR 251 and MATH 242 with a grade of "C" or better. (SPRING)

IEGR 360: ERGONOMICS AND WORKPLACE DESIGN - Four hours lecture and laboratory; 3 credits. This introductory course mainly focuses on occupational aspects of ergonomics. Human motor capabilities and limitations are addressed in the context of work and workplace design. Topics of discussion include anthropometry, work physiology, biomechanics, psychophysics, work methods/standards, time and motion study, the analysis and design of work, tools/equipment, musculoskeletal disorders, and environmental stressors such as noise, vibration, illumination and heat stress. Prerequisites: PHYS 205 and IEGR 251. Student must pass PHYS 205 and IEGR 251 with a grade of "C" or better. (FALL)

IEGR 361: INTRODUCTION TO LINEAR PROGRAMMING - Three hours lecture; 3 Credits.
Essentials of linear algebra including vectors and matrices manipulations & definitions; matrix operations, determinant of square matrix, inverse of a matrix; quadratic forms, principal minor; convex and concave functions and convex sets. Solving systems of linear equations; plotting linear equations and inequalities, graphical solutions, extreme points and feasible region; Introduction to linear programming and formulation of LP models, objective functions and constraints and optimal solutions; Principles of the simplex method; standard form, simplex method in tableau form, finding feasible solutions and performing iterations; computer solutions of LP. Prerequisite: MATH 241. Student must pass MATH 241 with a grade of "C" or better. (FALL)

IEGR 363: MANUFACTURING PROCESSES - Five hours lecture and laboratory; 3 credits. Defining the role of manufacturing processes in product development and manufacturing. Review of elements of materials engineering as related to manufacturing processes. Introduction of different processes including how they are done, when they are done, what are the tools and equipment required, design considerations, safety, product applications, and future trend and research interests for each process. Processes covered include casting, rolling, forging, extrusion, and CNC machining (mill & lathe). Other discussions include heat treatment, powder metallurgy, sheet metal forming, plastic and composite processing technology and welding and joining processes. Brief introduction to nontraditional manufacturing processes including mechanical, electrical, thermal and chemical processes. Review of common aspects of manufacturing such as metrology and instrumentation, quality assurance, testing and inspection, human factors engineering, safety, and product liability. Prerequisite: IEGR 309. Student must pass IEGR 309 with a grade of "C" or better. (FALL)

IEGR 367: PRODUCTION AND OPERATIONS MANAGEMENT - Three hours lecture and laboratory; 3 credits. Concepts of design and control of production systems, including organization, plant layout, economic analysis, work methods and measurements, and time and motion study. Design of physical manufacturing systems; integrating material handling systems, site and plant location. Project planning, control and network analysis including PERT/CPM,

Crashing and stochastic models.
Prerequisites: IEGR 350; Student must pass IEGR 350 with a grade of "C" or better. Co-requisite: IEGR 360, and IEGR 361. (FALL)

IEGR 402: SOFTWARE AND DATABASE DESIGN - Four hours lecture and Laboratory; 3 credits. Introduction to the principles of Software and Data-Base Engineering which is applied to the development of Application Software Systems. Systems analysis and design theory will be introduced using Object-Oriented Analysis and Design (OOAD) methodologies. Using the OOAD methodology in conjunction with use-case methods, software applications will be analyzed, modeled and simulated. Emphasis will be placed on students understanding how to diagram system components and their complex relationships. Numerous case studies will be used. Prerequisite: IEGR 304. Student must pass IEGR 304 with a grade of "C" or better. (FALL)

IEGR 404: PROGRAMMING FOR INDUSTRIAL ENGINEERING APPLICATIONS - Four hours lecture and lab; 3 credits. This course combines advanced programming techniques using various software systems with related course projects that incorporate other relative engineering subject areas. The focus will be on (1) the usage of Microsoft Visual C++ (advanced C++ programming), robot programming (for one or more robot platforms), Microsoft Excel (advanced spreadsheet programming), Microsoft Word (advanced word processing), LP_Solve (linear programming) and advanced simulation techniques to solve various manufacturing and service related problems, and (2) the engagement of newly developed laboratory programming modules/projects with realistic industrial engineering applications. Prerequisite: IEGR 304. Student must pass IEGR 304 with a grade of "C" or better. Co-requisite: IEGR 361. (SPRING)

IEGR 406: INDUSTRIAL SAFETY AND HEALTH - **Four** hours lecture; 3 credits. Survey of procedures and practices in industrial safety including government regulations (OSHA), life safety, electrical safety, air contamination, noise, radiation, ventilation, illumination, toxicology, and safety engineering organization. Prerequisite: Junior Standing. (SPRING)

IEGR 408: HEALTH CARE MANAGEMENT SYSTEMS AND SERVICES – Three hours lecture; 3 credits. Overview of the evolution, structure and current issues in the health care system, unique features of health care as a product, and the changing relationships between patients, physicians, hospitals, insurers, employers, communities, and government, efficiency and engineering aspects of health care system in the United States, optimization methods in health care models, efficient design of health care facilities, the impact of cost containment and competition on hospitals and integrated delivery systems, long term care and disease management, and the important role of epidemiology in assessing population health needs and risks, developments in the biotechnology, pharmaceutical, medical devices, genomics and IT industries. Prerequisites: Senior standing and permission of instructor. (SPRING)

IEGR 410: SIMULATION OF INDUSTRIAL SYSTEMS - Five hours lecture and laboratory; 3 credits. Introduction to analytic modeling and discrete event simulation of queuing systems with associated statistical concepts. Applications to industrial system modeling include production systems, inventory analysis and other aids to decision making. One simulation language is covered in detail and several others are discussed with animation demonstrated. Prerequisite: IEGR 304; Student must pass IEGR 304 with a grade of "C" or better. Co-requisite: IEGR 351. (SPRING)

IEGR 417 / SEGR: 417: SYSTEMS ENGINEERING: PRINCIPLES AND TECHNIQUES - Three hours lecture and laboratory; 3 Credits. Introduction to systems engineering concepts. Systems structure, open-loop and closed-loop systems, positive and negative feedback. Applications to production and inventory systems, population and physical systems. Analytical foundation of systems engineering, calculus of finite differences, Fourier analysis, and use of transform techniques in linear systems analysis. Prerequisites: Math 242 and Junior Standing. Student must pass MATH 242 with a grade of "C" or better. (FALL)

IEGR 420: INFORMATION SYSTEMS DESIGN - Three hours lecture and laboratory; 3 credits. Study of information systems development to include design, implementation, evaluation and management based on a standard development of life cycle methodology. Structured analysis and design techniques are introduced.
Prerequisites: IEGR 304 and Junior Standing. Student must pass IEGR 304 with a grade of "C" or better. (SPRING)

IEGR 432: INTRODUCTION TO QUALITY ENGINEERING - Three hours lecture; 3 credits. Engineering and Robust Design. Description: Off-line quality control. Build high quality into products in the design and development stages. Design high-quality products at low production cost by using quality loss function, experimental design, fractional factorial design as well as response surface methods. The objective is to design a product that is robust or less sensitive to manufacturing variations, environmental conditions and deterioration over time. Prerequisite: IEGR 351. Student must pass IEGR 351with a grade of "C" or better. (FALL)

IEGR 435 / SEGR 435: QUANTITATIVE METHODS IN SYSTEMS ENGINEERING - Three hours lecture and laboratory; 3 credits. This course provides quantitative modeling and analysis techniques, as well as the application to decision making in systems engineering. Topics include introduction to operations management, matrix algebra, formulation of optimization models, probabilistic methods and decision analysis, quality assurance and reliability, introduction to stochastic models, system simulation, network analysis and logistics management and computer-based solution by software.
Prerequisites: IEGR 351 and IEGR 417. Student must pass IEGR 351 and IEGR 417 with a grade of "C" or better. (SPRING)

IEGR 439: ENVIRONMENTAL MANAGEMENT ISSUES - Three hours lecture; 3 credits. Introduction to major environmental problems in industry. Discussions in environmental ethics/ecology, development of environmental concerns, public policy and the environment, responses to environmental problems including strategies for business/society. Environmental impact in energy conversion/utilization. Case studies include hazardous waste disposal, air and water pollution.
Prerequisite: Senior Standing. (SPRING)

IEGR 441: STOCHASTIC MODELS OF OPERATIONS RESEARCH - Three hours lecture; 3 credits. Basic concepts and techniques of stochastic operations research modeling. Topics include Markov chains, queuing theory, inventory systems, reliability, forecasting, decision analysis and introduction to simulation. Applications to engineering problems including the use of computer codes are also covered. Prerequisite: IEGR 351 and IEGR 361. Student must pass IEGR 351 and IEGR 361 with a grade of "C" or better. (FALL/SPRING)

IEGR 444 HONORS RESEARCH - 3 credits. Specially designed for honors students, independent inquiry into an industrial engineering related topic under the guidance of a faculty advisor. Prerequisite: Honors standing, Research Advisor's Consent and Department Chair's Approval. (FALL/SPRING)

IEGR 446: INTRODUCTION TO SOFTWARE ENGINEERING - Three hours lecture and laboratory; 3 credits. This course introduces software engineering principles, which includes the body of knowledge, software design, user interface issues, software requirements analysis, software construction, code reuse, software development life cycle, team-based software development, assessing design quality, design reviews and code inspections, software testing, and basic support tools. Prerequisite: IEGR 304 and Junior standing. Student must pass IEGR 304 with a grade of "C" or better. (FALL)

IEGR 451: DESIGN OF EXPERIMENTS AND INTRO. TO QUALITY CONTROL - Three hours lecture; 3 Credits. Includes Single Factor Experimental Design, Introduction to Factorial Experiments, Blocks and Latin Squares and related Designs, Introduction to Quality Control, Control Charts for Variables and Attributes, The DMAIC Process, Process and Measurement System Capability Analysis, and Different Statistical Process Monitoring and Control Techniques. Prerequisite: IEGR 351. Student must pass IEGR 351 with a grade of "C" or better. (SPRING)

IEGR 452: PROJECT MANAGEMENT - Three hours lecture and laboratory; 3 credits. The concept of project planning and organization, project life cycle, project scheduling, organizational forms and conflict resolution will be addressed. The use of schedule and technical planning and control methods such as WBS and network models as AOA, AON, and CPM/PERT will be stretched. Proposal writing and the use of project management software tools for creating a typical project plan will be explored. Prerequisites: IEGR 367. Student must pass IEGR 367 with a grade of "C" or better. (FALL/SPRING)

IEGR 454: THEME PARK DESIGN & FACILITIES PLANNING - Three hours lecture and lab; 3 credits. Introduces the concept of planning traditional facilities and theme park-based facilities, as well as the expansion/revision of these types of existing facilities using quantitative methods involving mathematical algorithms with computer programming, linear programming, computer simulation, material handling systems analysis, and engineering economic analysis. Special emphasis will be placed on Theme Park Engineering where detailed theme park planning, design, and operations are examined. In addition, rollercoaster design, as well as the design of other rides/ride systems will be examined. Prerequisites: IEGR 304 and IEGR 317. Student must pass IEGR 304 and IEGR 317 with a grade of "C" or better. Co-requisites: IEGR 361 and IEGR 367. (SPRING)

IEGR 455: MULTIMEDIA INSTRUCTIONAL DESIGN - Five hours lecture and laboratory; 3 credits.
The materials covered include: Delivery technologies, multimedia platforms, peripherals (sound cards, video cards, CD-ROM, Photo CD, Writeable and Re-writeable CD-ROM), multimedia in Windows environment, networking, planning, design, content provisions, and production media management, compression data standards (sound, video, image, text), data capture (text, sound, etc.), data administration, software development, authoring tools, pedagogical issues, intellectual property rights, copyright, licensing production, Internet navigation via World Wide Web (Internet Explorer & Netscape), FTP, email, HTML, JAVA, VRML, presentation software, learning styles, teaching methodologies, effective communication, multimedia-based learning, image/sound/video capturing and manipulation, constructing movies (combining image, video, and sound), story boards, 3-D animation tools (Truespace, 3-D Studio), creating multimedia projects (Director, Premier), authoring tools (Authorware, Toolbook), CD-ROM production, and identification of learning styles. Prerequisites: IEGR 304, Junior standing, and permission of instructor. Student must pass IEGR 304 with a grade of "C" or better. (FALL)

IEGR 459: INTRODUCTION TO LOGISTICS MANAGEMENT AND SUPPLY CHAIN - Three hours lecture and laboratory; 3 credits. A study on the discipline and philosophy of logistics and supply chain management with the high level strategy design and concepts utilizing the analytical and mathematical tools to solve simultaneous cost reduction and service enhancement problems. Within the strategic framework of supply chain and logistics management, topics like inventory, transportation information and facility oriented philosophies and techniques will be explored as knowledge integration of logistics and supply chain methodologies. Prerequisite: IEGR 367. Student must pass IEGR 367 with a grade of "C" or better. (FALL)

IEGR 460: ERGONOMICS AND HUMAN FACTORS - Four hours lecture and laboratory; 3 credits. This course focuses on human sensory, control, decision and motor systems in the context of auditory, visual, cognitive, and manual task design. Issues with noise, illumination, climate, motion, eye-hand coordination and human control of systems are presented. The principles applied to system, computer display, workplace and vehicle design are discussed. Prerequisite: IEGR 360. Student must pass IEGR 360 with a grade of "C" or better. (SPRING)

IEGR 461: OPEARTIONS RESEARCH, DETERMINISTIC MODELS - Three hours lecture and laboratory; 3 credits. Review of simplex method; sensitivity analysis, duality theory and applications in LP; parametric programming, integer programming, goal programming; transportation and assignment problems, network models; Prerequisite: IEGR 361. Student must pass IEGR 361 with a grade of "C" or better. (SPRING)

IEGR 462: ARTIFICIAL INTELLIGENCE: PRINCIPLES AND TECHNIQUES - Four hours lecture and laboratory; 3 credits. Foundational principles that drive complex real-world problems applications and practice implementing some of the web search, speech recognition, face recognition, machine translation, autonomous driving, and automatic scheduling systems. The goal of Artificial intelligence (AI) is to tackle these with rigorous mathematical tools. Specific topics include machine learning, search, game playing, Markov decision processes, constraint satisfaction, graphical models, and logic. Prerequisites: IEGR 304 and IEGR 461. Student must pass IEGR 304 and IEGR 461 with a grade of "C" or better. (FALL)

IEGR 467: PRODUCTION ANALYSIS AND MANUFACTURING SYSTEMS - Four hours lecture and laboratory; 4 credits. Principles and concepts of the design, planning and control of production and manufacturing systems, including Process Technology Design, Manufacturing Lead Time (MLT) Analysis, Process Planning and Design, Computer Aided Process Planning (CAPP), Group Technology (GT) Analysis, Assembly Line balancing Techniques, Lean Production and Synchronous Manufacturing, Material Requirements Planning (MRP) & Manufacturing Resource Planning (MRP II) concepts, Flow Manufacturing & Just-in-Time (JIT) Concepts, and introduction to Material Handling Systems (MHS) and Facilities Planning. Prerequisites: IEGR 367; Student must pass IEGR 367 with a grade of "C" or better. Co-requisite: IEGR 461. (SPRING)

IEGR 468: ADVANCED MATERIAL HANDLING SYSTEMS - Three hours lecture and laboratory; 3 credits. Provide the basic understanding of design and control issues involving material handling systems (MHS). Develop a keen awareness for identifying potential cost saving opportunities in material handling applications. Addressing material handling systems design requirements for automated manufacturing and warehouse systems including: Facility Location problems, Unit Load Analysis, Automated Guided Vehicle (AGV) Analysis, Robotic Applications, Automated Storage Retrieval System (ASRS) Analysis, Conveyer Analysis, Automated Identification System, and Process Control using Programmable Logic Controllers (PLCs). Prerequisites: IEGR 304, IEGR 363, and IEGR 367. Student must pass IEGR 304, IEGR 363, and IEGR 367 with a grade of "C" or better. (SPRING)

IEGR 470: INDUSTRIAL ROBOTICS - Five hours lecture and laboratory; 3 credits. Principal concepts are the organization and operation of microcomputer-controlled manipulators. Experiments include kinematics, manipulation, dynamics, and trajectory planning and programming language for robots. Applications of computer-controlled robots in manufacturing and programmable automation. Prerequisites: IEGR 304, IEGR 363 and IEGR 367. Student must pass IEGR 304, IEGR 363 and IEGR 367 with a grade of "C" or better. (FALL)

IEGR 477 / SEGR 477: SPACECRAFT SYSTEMS ENGINEERING Five hours lecture and laboratory; 3 credits. This course is designed for the engineering students who choose systems engineering as their concentration of study. The course covers the application of systems engineering in spacecraft development cycle. Topics will address systems engineering approaches in conceptual and technology development, preliminary design, final design and fabrication, integration and test, launch and operations management, risk management and life cycle analysis. Prerequisites: IEGR 417. Student must pass IEGR 417 with a grade of "C" or better. (FALL)

IEGR 478: COMPUTER AIDED MANUFACTURING - Five hours lecture and laboratory; 3 credits. Introduction to the use of CAM systems, including integration of Computer Aided Design (CAD) in part-design specification and intermediate analysis, Concurrent Engineering (CE), Design for Manufacturing (DFM), Process Engineering, Fixed Automation, Group Technology (GT), Computer Aided Process Planning (CAPP) / Computer Managed Process Planning (CMPP), NC Programming, Computer Numerical Control (CNC), and introduction to electronics manufacturing. Prerequisites: IEGR 317 and IEGR 363. Student must pass IEGR 317 and IEGR 363 with a grade of "C" or better. (SPRING)

IEGR 479: ASSEMBLY DESIGN AND PLANNING - Four hours lecture and laboratory; 3 credits. A study of various topics related to design, planning and fabrication of mechanical assemblies. This includes design for assembly (DFA) principles, joining processes, design of weldments and mechanical fasteners, design for assembly jigs and fixtures, part feeding principles, assembly sequencing and process planning, and planning and control of manual and automated assembly systems. Various format of standard data exchange between assembly phase and total life cycle data and the assembly design principles will be explored. Prerequisites: IEGR 317 and IEGR 367. Student must pass IEGR 317 and IEGR 367 with a grade of "C" or better. (FALL)

IEGR 480: PRODUCT DESIGN - Five hours lecture and laboratory; 3 credits. Dynamics of converting ideas to marketable products. The use of programming skills and numerical tools to support design/redesign of products, in a 3 -D solid modeling computer workstation environment. Course covers the trajectory from product idea to design and prototype development and production. Course involves several design experiments, and requires the team design and rapid production of prototypes. Prerequisites: IEGR 317 and IEGR 363. Student must pass IEGR 317 and IEGR 363 with a grade of "C" or better. (FALL)

IEGR 485: ADVANCED MULTIMEDIA INSTRUCTIONAL DESIGN - Four hours lecture and laboratory; 3 credits. Internet Navigation via World Wide Web; FTP, E-mail, HTML. JAVA, VRML. Presentation software, Teaching methodologies; Effective communication; Multimedia-based learning. Image/sound/video capturing and manipulation, Constructing movies (combining image, video, and sound), Story boards, 3-D animation tools (Truespace, 3-D Studio), Creating multimedia projects (Director, Premier), Authoring tools Authorware, Toolbook, Simple), CD-ROM production, and Identification of learning styles. Prerequisites: IEGR 455 and Senior standing and/or permission of instructor. Student must pass IEGR 455 with a grade of "C" or better. (SPRING)

IEGR 488: FLEXIBLE MANUFACTURING SYSTEMS - Four hours lecture and laboratory; 3 credits. Introduction of Flexible Manufacturing systems (FMS), including manufacturing cells, physical planning, human resources, Just-In–Time (JIT) manufacturing, processing and quality assurance equipment and systems, system support equipment, FMS computer hardware, software, and communication network and FMS installation and implementation aspects. Prerequisites: IEGR 317, IEGR 363, and IEGR 367. Student must pass IEGR 317, IEGR 363, and IEGR 367 with a grade of "C" or better. (SPRING)

IEGR 496: SENIOR DESIGN I - 1 credit. A capstone design course emphasizing analysis and design in a specific industrial engineering problem area under the guidance of a faculty advisor. Students are expected to devote at least six unscheduled hours for each scheduled credit hour for this course. During this phase the student or student team is to identify the problem and analyze optional solutions and submit a written proposal describing how the project is to be executed during the follow-on course IEGR 498. Prerequisite: Project Advisor's Consent and Department Chair's Approval. . (FALL/SPRING)

IEGR 497: HONORS SENIOR DESIGN - 3 credits. Specially designed for honors students. A capstone design course emphasizing analysis and design in a specific industrial engineering problem area under the guidance of a faculty advisor. Students are expected to devote at least six unscheduled hours for each scheduled credit hour for this course. This course combines the two-semester sequence IEGR 496 and IEGR 498 into a single semester course for honors students. A final written report and oral presentation of the project and its results are also required. Students are also required to pass an IE comprehensive examination. Prerequisite: Honors Standing, project advisor's Consent and Department Chair's Approval. (FALL/SPRING)

IEGR 498: SENIOR DESIGN II - 2 credits. This course is a follow-on execution of the project proposed in course IEGR 496. Students are expected to devote at least six unscheduled hours for each scheduled credit hour for this course. A final written report is required of the students. If a team of students executed the project, each student is required to submit a report describing the special aspects of the project executed by the student. An oral presentation of the project and its results is also required. The report should contain a summary of data and analysis that led to the design recommendation. Students are also required to pass an IE comprehensive examination.
Prerequisites: IEGR 496, and project Advisor's Consent and Department Chair's Approval. (FALL/SPRING)

IEGR 499: SPECIAL TOPICS - 3 credits. In-depth study of recent advances in specific areas of student/faculty interest. Prerequisite: Advisor's Consent and Department Chair's Approval. . (FALL/SPRING)

MORGAN STATE UNIVERSITY SCHOOL OF ENGINEERING INDUSTRIAL ENGINEERING CURRICULUM SEQUENCE

FRESHMAN YEAR (FIRST SEMESTER)

CHEM 110	General Chemistry for Engineering	4
ECON 2111	Principles of Economics	3
ENGL 101	Freshman Composition I	3
MATH 241	Calculus I	4
ORIE 104	Introduction to Engineering	1
		15

SOPHOMORE YEAR (FIRST SEMESTER)

IEGR 251	Probability & Statistics for Eng - I	3
IEGR 304	Intro to Programming to IE	3
IEGR 350	Engineering Economy	3
PHYS 206	University Physics II	5
PHEC xxx	Physical Education	1
		15

JUNIOR YEAR (FIRST SEMESTER)

IEGR 360	Ergonomics & Workplace Design	3
IEGR 361	Intro to Linear Programming	3
IEGR 363	Manufacturing Process	3
IEGR xxx2	IE Concentration Elective	3
PHIL 109	Introduction to Logic	3
		15

SENIORT YEAR (FIRST SEMESTER)

IEGR 367	Production & Operations Mgmt	3
IEGR 451	Design of Experiment & QC	3
IEGR 480	Product Design	3
IEGR 4965	Senior Design - I	1
IEGR xxx2	IE Concentration Elective	3
LANG 1023	Foreign Language 102 or Higher	3
		16

1May be substituted by any approved Social and Behavioral Science Electives.
2Must be from the approved Industrial Engineering Concentration Elective courses.
3May be substituted by any approved Arts and Humanities Electives.

FRESHMAN YEAR (SECOND SEMESTERT)

ENGL 102	Freshman Composition II	3
IEGR 204	Intro to IE and Computers	2
MATH 242	Calculus II	4
PHYS 205	University Physics I	5
		14

SOPHOMORE YEAR (SECOND SEMESTER)

IEGR 305	Thermodynamics	3
IEGR 309	Materials Engineering	3
IEGR 317	Solid Modeling and Design – I	3
IEGR 351	Probability & Statistics for Eng - II	3
PSYC 1011	General Psychology	3
		15

JUNIOR YEAR (SECOND SEMESTER)

HUMA 2013	Introduction to Humanities I	3
IEGR 461	OR, Deterministic Models	3
HEED 1034	Health Science: H&S Determinants	3
IEGR 410	Simulation of Industrial Systems	3
MATH 340	Differential Equation	3
		15

SENIORT YEAR (SECOND SEMESTER)

HIST 350	Intro to African Diaspora	3
XXXX xxx6	Engineering Elective	3
IEGR 467	Prod Anal & Manufacturing Sys	4
IEGR 4985	Senior Design - II	2
IEGR xxx2	IE Concentration Elective	3
		15

TOTAL CREDITS	120

4May be substituted by any approved Health and Healthful Living Electives.
5Consent of project advisor(s) and approval of department chair are required prior to registration.
6Must be from the ISE Department approved Engineering Elective courses.

TRANSPORTATION SYSTEMS

Chairperson of Department: PROFESSOR ANTHONY A. SAKA; Associate Professor: YOUNG-JAE LEE; Associate Professor MANSOUREH JEIHANI; and Assistant Professor: CELESTE N. CHAVIS

THE MAJOR IN TRANSPORTATION SYSTEMS

The B.S. degree program in Transportation Systems provides a hybrid curriculum that prepares students for entry-level professional positions in transportation planning, systems analysis, management, and logistics; or for pursuing advanced studies. The program is technical with an applied science focus, and requires a minimum of 120 credit hours of coursework, which includes 40 credit hours in general educational, 20 credit hours of mathematics and science, 56 credit hours in core courses, 2 credit hours in University requirements, and 2 credit hours in electives. The core courses expose the students to the major transportation concentration areas, including planning, engineering, economics, management, and logistics.

OBJECTIVES

The program graduate will:

- Utilize system approach to articulate, study, and mitigate transportation problems
- Apply latest technology and sustainability paradigm to efficiently plan, implement, analyze, evaluate, and manage components of the transportation systems
- Utilize effective communication, team, leadership and total quality management skills to work productively within their professions and communities
- Pursue professional development and advanced studies to meet the emerging and evolving demands, and increasing responsibilities of a successful career
- Conduct themselves as responsible professionals and citizens

PROGRAM OUTCOMES

The program graduates will be able to:

- Develop knowledge of local and global cross-cutting issues and challenges in transportation and engage in life-long learning
- Formulate or design a system, process, or program to meet desired needs
- Apply mathematics, science, technological tools, and principles of engineering, planning and management to solve complex transportation-related problems
- Understand the impact of solutions in a global and societal context
- Communicate effectively and function on multidisciplinary team
- Design and conduct experiments as well as analyze and interpret data
- Understand professional and ethical responsibility, and recognize the Institute of Transportation Engineers (ITE) Canons of Ethics for Members

A. General Education and University Requirements

Course #	*Course Title*	*Credits*
BIOL 101	Introduction to Biology	4
CEGR 107	Computer Aided Design	3
ECON 212	Principles of Economics II	3
ENGL 101	Freshmen Composition I	3
ENGL 102	Freshmen Composition II	3
HEED 103	Human & Social Determinants	3
HIST 350	Introduction to Black Diaspora	3
HUMA 201	Introduction to Humanities I	3
HUMA 202	Introduction to Humanities II	3
MHTC 103	Introduction to Group Dynamics	3
PHIL 109	Introduction to Logic	3
TRSS 301	Introduction to Transport Systems	3
MATH XXX	Pre-Calculus or higher	3
Total Credits		40

B. Mathematics and Science Requirements

Course #	*Course Title*	*Credits*
MATH 118	Finite Mathematics	3
MATH 120	Probability & Decision Making	3
MATH 241	Calculus	4
CHEM 110	Chemistry for Engineers	4
CHEM 110L	Chemistry Lab	1
PHYS 205	Physics I	4
PHYS 205L	Physics I Lab	1
Total Credits		20

C. Transportation Requirements

Course #	*Course Title*	*Credits*
ENGL 357	Technical or Business Writing	3
GEOG 309/OR	Urban Land Use OR	
TRSS 305	Urban Land Use Planning	3
TRSS 105	Seminar on Professional Practice	1
TRSS 307	Freight Transportation Systems & Logistics	3
TRSS 318	Transportation Planning & Policy	3
TRSS 319	Geographic Information Systems	3
TRSS 399	Transportation Practicum	3
TRSS 402	Transportation Economics	3
TRSS 406	Public Transportation Systems	3

TRSS 408	Advanced Logistics Systems	3
TRSS 410 OR	Management of Transportation Systems OR	
MGMT xxx	Approved Management Elective	3
TRSS 412	Transportation Infrastructure/Asset Management	3
TRSS 414/OR	Traffic Engineering OR	
CEGR 465	Traffic Engineering	3
TRSS 415	Highway Engineering	3
TRSS 416	Microcomputer App in Transportation	3
TRSS 417	Intelligent Transportation Systems	3
TRSS 418	Advanced Transportation Planning	3
TRSS 420	Transportation Systems Evaluation	3
TRSS 497	Senior Transportation Seminar	1
TRSS 499	Senior Transportation Project	3
XXX xxx	Electives	2
Total Credits		58

D. University Requirements

Course #	*Course Title*	*Credits*
OREN 104	Introduction to Engineering	1
PHEC xxx	Physical Education Elective	1
Total Credits		2

OREN 104 – Introduction to Engineering – One Credit Hour
This course is designed to prepare students for the rigors of earning an engineering degree. It introduces students to the expectation 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)

TRSS 105 Seminar on Professional Practice – One Credit Hour
This is a seminar arrangement intended to continually arouse the interest of first-year students in transportation and maintain their interaction with the transportation faculty and transportation professionals as they take the majority of courses outside the department to satisfy the general education requirement. The seminar will involve presentations on professional ethics, current and future state of the transportation profession, and roles of the different transportation modal agencies by invited guests from the public and private sectors. (Spring)

TRSS 301 Introduction to Transportation Systems – Three Credit Hours
This is the introductory course for transportation systems. It will discuss the basic concepts and strategies in the study of systems, key issues pertaining to the different areas of transportation including planning, engineering, management, and logistics. The historical, physical, economic, social, and environmental aspects of transportation will be covered. (Fall, Spring)

TRSS 305 Urban Land Use Planning – Three Credit Hours
This course deals with the basic concepts, principles, strategies, and tools of urban land use planning. Emphasis will be on the interaction between transportation and land use variables, including modeling requirements, impacts, and data needs within the context of good community planning and economic development. (Fall)

TRSS 307 Freight Transportation Systems and Logistics – Three Credit Hours
The course will provide basic concepts of supply chain management, including customer service, transportation, inventory, location theory, etc. The relationship between components of supply chain management is also examined. **Prerequisite**: TRSS 301 or permission of the Instructor. (Fall)

TRSS 318 Transportation Planning and Policy – Three Credit Hours
This course will cover the relationship between land use and transportation, landmark transportation planning-related policies, traditional four-step planning process and the respective mathematical models and algorithms, noise and air quality issues, and transportation systems capacity analysis. **Prerequisite**: TRSS 301 or permission of the Instructor. (Spring)

TRSS 319 Geographic Information Systems (GIS) – Three Credit Hours (two hours lecture, two hours lab)
This course will expose the student to the concept of spatial analysis using GIS tools. Topics covered will include GIS need assessment, mapping of spatial entities, linear referencing, development of a GIS-based decision support system, and applications in asset management and planning. (Fall)

TRSS 399 Transportation Practicum – Three Credit Hours
This course will provide practical experience in the field of transportation by placement with a transportation agency or a faculty mentor. The student will have the opportunity
To work on and complete a real project under the direct supervision of a transportation planner, engineer, manager, or faculty for a minimum period of three months. **Prerequisite**: Junior status. (Fall, Spring, Summer)

TRSS 402 Economics of Transportation – Three Credit Hours
This course reinforces the microeconomic tools necessary for understanding, analyzing, and managing transportation firms and industries. The subjects covered will include costs, pricing behavior, inter-modal competition, and strategic decision making. **Prerequisite**: ECON 212 or ECON 211 and MATH 114 or equivalent, and Junior status. (Fall)

TRSS 406 Public Transportation Systems – Three Credit Hours
The role of the various types of public transportation systems including bus, rail, and other new modes will be examined. The technology, planning, operation, management, and policy aspects of public transportation will be covered. **Prerequisite**: TRSS 301 or permission of the Instructor, MATH 114 or equivalent, and Junior status. (Fall)

TRSS 408 Advanced Logistics and Supply Chain Management – Three Credit Hours (three hours lecture, one hour lab)
This course will offer in-depth analytical tools for supply chain management, including linear programming, manufacturing procedures, network analysis, inventory management, location theory, etc. The course will comprise computer applications, case studies and seminars. **Prerequisite**: TRSS 307 and MATH 118. (Spring)

TRSS 410 Management of Transportation Systems – Three Credit Hours
This course will discuss managerial issues and problems in the transportation industries, including economic, marketing, operational, financial, labor relations, and institutional components. Prerequisite: Junior status. (As needed)

TRSS 412 Transportation Infrastructure/Asset Management – Three Credit Hours (three hours lecture, one hour lab)
This course will be designed to discuss the use of geo-spatial analytical tools, inventory control and equipment replacement models to develop decision support systems for making informed decisions in maintaining and replacing transportation infrastructure and assets. **Prerequisit**e: TRSS 319 and MATH 118 or higher, and Junior status (Fall)

TRSS 414 Traffic Engineering – Three Credit Hours (three hours lecture, one hour lab)
This course will cover the basic concept of traffic flow theory, collection and analysis of traffic data, level of service concept, capacity analysis of interrupted and uninterrupted flows, traffic control devices, accident analysis and countermeasures, traffic impact studies, and pedestrian and parking facilities analysis. **Prerequisite**: MATH 241 and Junior status (Fall)

TRSS 415 Highway Engineering – Three Credit Hours (three hours lecture, one hour lab)
This course will be designed to provide the basic concept of highway systems performance analysis and design. Topics covered will include human factors; vehicle and roadway characteristics; engineering properties of highway materials; highway geometric, structural and drainage design; and capacity analysis of freeway, multilane and two-lane highways. **Prerequisite**: MATH 241 and Junior status. (Fall)

TRSS 416 Microcomputer Applications in Transportation – Three Credit Hours (two hours lecture, two hours lab)
This course will discuss a collection of state-of-the-art software packages that are commonly used in the different transportation professional areas including the Highway Capacity Software (HCS), and software for traffic engineering, transportation planning and distribution logistics. **Prerequisite**: TRSS 414, TRSS 415, and Junior status. (Spring)

TRSS 417 Intelligent Transportation Systems – Three Credit Hours
This course will be designed to expose the student to the role of new technology in transportation particularly in the areas of travel information, traffic and incident management, public transportation, freight transportation, and inventory control. The history and cross-cutting issues in intelligent transportation systems deployment in the U.S. will be examined. **Prerequisite**: TRSS 301 and Junior status. (Spring)

TRSS 418 Advanced Transportation Planning – Three Credit Hours (two hours lecture, two hours lab)
The course will reinforce the subjects covered in the Transportation Planning course with case studies and hands-on applications. Discussions will include the 3-C process, travel demand simulation, transportation plan development and project programming, noise and air quality analysis, and environmental justice. **Prerequisite**: TRSS 318 and Junior status. (Spring)

TRSS 420 Transportation Systems Evaluation – Three Credit Hours
This course will focus on analytical methods commonly used in transportation planning. Discussions will include transit, highway and traffic-intersection capacity analysis, the transportation planning process, benefit-cost analysis, and environmental impact assessment process. **Prerequisite**: TRSS 301, MATH 114 or equivalent, and Junior status. (Spring)

TRSS 497 Senior Transportation Seminar – One Credit Hour
This is a seminar arrangement intended to expose students to the art of developing research proposals, including identifying topics for senior projects; using statistical and other quantitative methods for data collection and analysis; and making oral presentation. The concepts and experience gained from TRSS 105, including ethical, contemporary, and global issues in transportation will be reinforced. Prerequisite: MATH 120 or higher and Senior status. (Fall)

TRSS 499 Senior Transportation Project – Three Credit Hours
This course will provide the student the opportunity to apply engineering, planning, and management tools in defining and solving a credible transportation problem, and presenting a final report to a panel of faculty members and invited transportation professionals. **Prerequisite**: TRSS 497 and Senior status. (Fall, Spring)

MORGAN STATE UNIVERSITY

SCHOOL OF ENGINEERING

TRANSPORTATION ENGINEERING CURRICULUM SEQUENCE

Freshman Year: Fall Semester

ENGL 101	Freshman Composition I	3
BIOL 101 CEGR 107	Computer Aided Design	3
MHTC 103	Intro to Group Dynamics	3
OREN 104	Introduction to Engineering	1
MATH 11Math XXX	Pre-Calculus or higher	3
		13

Sophomore Year: Fall Semester

CHEM 110BIOL 101	Introduction to Biology	4
HUMA 201	Introduction to Humanities I	3
MATH 120	Probability & Decision Making	3
PHIL 109	Introduction to Logic	3
tation Systems		3
		16

Junior Year: Fall Semester

MATH 241 GEOG 309/	Urban Land Use OR	
TRSS 305	Urban Land Use Planning	3
PHYS 205	Physics I	4
PHYS 205L	Physics I Lab	1
TRSS 307	Freight Transportation Systems and Logistics	3
TRSS 319	Geographic Information Systems	3
HIST 350		
TRSS 406	Public Transportation Systems	3
		17

Senior Year: Fall Semester

TRSS 40TRSS 399	Transportation Practicum	3
TRSS 402	Transportation Economics	3
TRSS 412	Transportation Infrastructure/Asset Management	3
TRSS 414	Traffic Engineering	3
TRSS 415	Highway Engineering	3
ENGL 357	Business Writing	
TRSS 497	Senior Transportation Seminar	1
		16

Freshman Year: Spring Semester

TRSS 105	Seminar on Professional Practice	1
ENGL 102	Freshman Composition II	3
HIST 10 HEED 103	Human & Social Determinants	3
MATH 118	Finite Math	3
ECON 212	Principles of Economics II	3
PHECxxx	Physical Education Elective 1	
		14

Sophomore Year: Spring Semester

PHIL 220		
HUMA 202	Introduction to Humanities II	3
MATH 241	Calculus	4
CHEM 110	Chemistry for Engineers	4
CHEM 110L	Chemistry for Engineers Lab	1
TRSS 318	Transportation Planning & Policy	3
GENL 201		
		15

Junior Year: Spring Semester

TRSS 3		
ENGL 357	Business Writing	3
HIST 350	Introduction to the African Diaspora	3
TRSS 408	Advanced Logistics & Supply Chain Management	3
TRSS 410/	Management of Transportation OR	
MGMT	Management Elective	3
TRSS 417	Intelligent Transportation Systems	3
PHYS 205		
		15

Senior Year: Spring Semester

TRSS 402	Transportation Economics	
TRSS 416	Microcomputer Applications in Transportation	3
TRSS 418	Advanced Transportation Planning	3
TRSS 420	Transportation Systems Evaluation	3
TRSS 499	Senior Transportation Project	3
XXXxxx	Approved Elective	2
		14

TOTAL 120 credits