

[< Back to Departments](#)

Course Descriptions ME

EGPP-101 Introduction to Engineering, 2 Credits

Provides information on engineering education, the engineering profession, and basic concepts and tools. Introduces the engineering design process and provides the opportunity for students to complete engineering design projects.

MEEG-103 Introduction to Computer Aided Design, 2 Credits

Introduction to engineering drawing and descriptive geometry, space visualization and coordinate systems, conventions, projection drawings, freehand sketching, vectors, and graphical mathematics. Freehand, instrument, and computer techniques are used.

MEEG-204 Solid Mechanics, 3 Credits

Presents basic concepts of stress and strain of deformable bodies, state of stress and strain, Mohr's circle, and bending of prismatic bars, among other topics.

MEEG-206 Solid Mechanics Lab, 1 Credit

Experiments designed to expose students to experimental techniques applicable in evaluation of the mechanical properties of materials including measurement of static and dynamic properties.

MEEG-207 Introduction to Engineering Computations, 3 Credits

Introduces programming with computers. Programming concepts include procedural thinking, algorithm development, and techniques for developing solutions to engineering problems using software packages such as MATLAB.

MEEG-209 Material Science, 3 Credits

Correlation of the structure of metals, ceramics, and organic materials with their mechanical and physical properties; control of properties by modifying the microstructure, and stability of materials in service environments.

MEEG-301 System Dynamics, 3 Credits

Introduction to modern control theory, including digital control and nonlinear system analysis. Mathematical modeling of physical systems with mechanical, fluid, thermal and/or electrical elements. Classical feedback control theory and design, and their application to practical electromechanical and aerospace problems.

MEEG-304 Thermodynamics, 3 Credits

Presents basic thermodynamic concepts and definition, laws of thermodynamics, properties of pure substances, and entropy and availability. Introduction to statistical thermodynamics.

MEEG-306 Applied Thermodynamics, 3 Credits

Study of mixtures, combustion, power cycles, gas turbines, and compressors; reciprocating engines, refrigeration, and reactive systems. Introduction to Onsager's relations and direct energy conversion. Laboratory work included.

MEEG-307 Fluid Mechanics I, 3 Credits

Includes properties and mechanics of fluids; kinematics; and control volume continuity, momentum, and moment of momentum equations.

MEEG-310 Mechanical Design I, 3 Credits

Integration of knowledge of strength of materials in a design context, stress and deflections in engineering structures. Theories of failure. Introduction to the design of machine components, such as screws, fasteners, bolts, welded joints, shafts, axles, and mechanical springs.

MEEG-311 Mechanical Design II, 3 Credits

Discusses frictional and wear considerations in design of mechanical systems. Also covers design of rolling contact bearing, journal bearings, spur, helical, bevel, and worm gears, clutches and brakes, flexible mechanical elements; hydrodynamic lubrication.

MEEG-316 Instrumentation and Experimentation Lab, 2 Credits

Basic principles of instruments and sensors employed in engineering measurements. Nature of experimental error and uncertainty analysis.

MEEG-319 Manufacturing, 3 Credits

Discusses major groups of manufacturing processes which consist of casting, forming, machining and joining processes. Each group of manufacturing processes includes several manufacturing techniques for producing diverse manufactured parts. Also, manufacturing processes for a competitive environment will be introduced. These processes include automation in manufacturing and computer-integrated manufacturing.

MEEG-320 Fluid Mechanics II, 3 Credits

Covers the fundamental physical concepts related to external flow. Students will demonstrate necessary problem-solving skills to solve basic engineering problems in fluid and aero systems in which fluid analysis is necessary.

MEEG-350 Computer Aided Engineering, 3 Credits

Theory and application of computer aided engineering based on FEA and CFD codes for the modeling, simulation and analysis of mechanical engineering systems.

MEEG-403 Heat Transfer, 3 Credits

Analytical and numerical treatment of heat transfer by conduction, convection, and radiation; steady and unsteady state heat flow; condensing vapors; and boiling liquids.

MEEG-423 Thermal/Fluid Science Lab, 1 Credit

Experiments designed to expose students to experimental techniques applicable in evaluation of the behavior fluid and thermal systems.

MEEG-441 Senior Project I, 3 Credits

Independent team design study of current interest under supervision of faculty members. Report must be submitted for review by mechanical engineering faculty before graduation.

MEEG-442 Senior Project II, 3 Credits

Team design study. Continuation of MEEG-441. Prerequisite: MEEG-441.

Technical Electives

MEEG-308 Aerofluid Dynamics, 3 Credits

Potential flow theory and compressible flow; circulation, vorticity and wing theory, shock waves, expansion waves and nozzles; introduction to boundary layer theory and applications.

MEEG-318 Jet Propulsion, 3 Credits

Power cycles, combustion fundamentals, aircraft and missile propulsion, engines compressors and turbines.

MEEG-416 Aerostructures, 3 Credits

Static analysis of aerospace structures; external loading and environment; failure theories of materials; deflection of unsymmetrical cross-section beams; thermal stress; torsion of thin-walled sections; stiffened shell structures, buckling of columns and plates; introduction to dynamic analysis.

MEEG-418 Vibration Analysis, 3 Credits

Covers single DOF, two DOF and multi-DOF systems of vibration analysis, mode shape functions, numerical solutions and software packages.

MEEG-421. Product Data Management, 3 Credits

Participants will study topics fundamental to global collaborative engineering, product data management, and collaborative product data management. These topics will be applied during team projects utilizing state of the art collaborative engineering and product data management software and hardware technologies. This course may also contain live online video lectures originating from participating universities.

MEEG-438 Environmental Control, 3 Credits

Analysis and design of heating, cooling, ventilation, and air distribution systems, including physiological and climatic factors, along with such new concepts of thermal systems as solar energy, total energy, and energy conservation.

MEEG-443 CAD/CAM, 3 Credits

Fundamentals of computer graphics and introduction to computer aided design software and solid modeling. Fundamentals of machining, numerical control and numerical control programming. Laboratory provides hands on experience in computer integrated manufacturing and CNC milling and turning.

MEEG-444 Robotics, 3 Credits

Kinematics and dynamics of robot manipulators, robot programming languages, structural members; fatigue, creep, and stress team or design study of current interest.

MEEG-445 Undergraduate Research I, 3 Credits

Analysis, design and/or experimentation in Instructor's area of interest.

MEEG-447 Computational Fluid Dynamics, 3 Credits

Solutions to fluid flow problems using computers. Students will gain familiarity with numerical methods and acquire experience in solving fluid mechanics and heat transfer problems using computers.

MEEG-450 MEMS, 3 Credits

Various topics related to Microelectromechanical systems (MEMS) are covered in the class. Those topics are

comprised of but not limited to micro-sensors, micro-actuators, optomechanical devices, and labs-on-a-chip.

MEEG-461 Energy Engineering I, 3 Credits

Introduction to modern energy sources useful for engineering applications. Includes fossil, nuclear, solar, wind, geothermal and biomass.

MEEG-462 Energy Engineering II, 3 Credits

Analysis of current practices governing use of energy sources. Effective utilization and economic considerations are discussed. New and emerging technologies (such as synfuels and cogeneration) are discussed.

MEEG-990/991 Co-op Mechanical Engineering, 1-12 credits

For students enrolled in the Cooperative Education Program during time spent in industry. Credit may be awarded based on evaluation of employer(s) and a written report by the student.

Table 2: EE-CpE curricula AND CS curriculum that is *starting in Fall 2016*

EE B.S. Curriculum			CpE B.S. Curriculum			CS B.S. Curriculum		
Number	Course Title	Cr.	Number	Course Title	Cr.	Number	Course Title	Cr.
MATH 156	Calculus I	4	MATH 156	Calculus I	4	CSCI-100	Intro to Computer Science	3
EECE 156	Math I Lab	1	EECE 156	Math I Lab	1		Non-technical Elective	3
EGPP 101	Intro. to Engineering	2	EGPP 101	Intro. to Engineering	2	EGPP 101	Intro. to Engineering	2
ENGW 104	Writing Literacy & Discourse	3	ENGW 104	Writing Literacy & Discourse	3	ENGW	English I	3
CHEM 003	Chemistry	4	CHEM 003	Chemistry	4		Science Lec A	4
CHEM 005	Chemistry Lab	1	CHEM 005	Chemistry Lab	1		Science Lab A	0
			PHED xxx	Physical Ed./ROTC	1			
	Total Credits Semester 1	15		Total Credits Semester 1	16		Total Credits Semester 1	15
MATH 157	Calculus II	4	MATH 157	Calculus II	4	MATH 156	Calculus I	4
EECE 157	Math II Lab	1	EECE 157	Math II Lab	1			
EGPP 102	Intro to Electrical Engineering and Computer Engineering	1	EGPP 102	Intro to Electrical Engineering and Computer Engineering	1	CSCI-211	UNIX Lab	1
ENGW 105	Reflective Writing Portfolio	3	ENGW 105	Reflective Writing Portfolio	3	ENGW	English II	3
PHYS 013	Physics Science and Eng. 1	3	PHYS 013	Physics Science and Eng. 1	3	SLMC 101	Principles of Speech	3
PHYS 023	Physics Science and Eng. 1 Lab	1	PHYS 023	Physics Science and Eng. 1 Lab	1	CSCI 135	Computer Science I	4
PHED xxx	Physical Ed./ROTC	1	PHED xxx	Physical Ed./ROTC	1			
	Total Credits Semester 2	14		Total Credits Semester 2	14		Total Credits Semester 2	15
MATH 158	Calculus III	4	MATH 158	Calculus III	4	MATH 157	Calculus II	4
EECE 158	Math III Lab	1	EECE 158	Math III Lab	1			
PHYS 014	Physics Science and Eng. 1	3	PHYS 014	Physics Science and Eng. II	3		Science Lec B (1)	4
PHYS 024	Physics Science and Eng. 1 Lab	1	PHYS 024	Physics Science and Eng. II Lab	1		Science Lab B (1)	0
CSCI 135	Computer Science I	4	CSCI 135	Computer Science I	4	CSCI 136	Computer Science II	3
	Social Science Elective	3		African American Studies Elective	3	CSCI 201	Computer Organization I	3
	Total Credits Semester 3	16		Total Credits Semester 3	16		Total Credits Semester 3	17
EECE 160	Engineering Mathematics	3	EECE 160	Engineering Mathematics	3	MATH 181	Discrete Math	3
EECE 260	Engineering Programming & Applications	3	CSCI 136	Computer Science II	3	CSCI 354	Computer Science III	3
EECE 203	Fundamentals of Circuit Theory	4	EECE 203	Fundamentals of Circuit Theory	4	CSCI 375	Software Engineering	3
EECE 209	Fundamentals of Circuit Theory Lab	1	EECE 209	Fundamentals of Circuit Theory Lab	1	CSCI 202	Computer Organization II	3
EECE 212	Fundamentals of Digital Systems	4	EECE 212	Fundamentals of Digital Systems	4		Science Lec B (2)	4
EECE 218	Fundamentals of Digital Systems Lab	1	EECE 218	Fundamentals of Digital Systems Lab	1		Science Lab B (2)	0
	Total Credits Semester 4	16		Total Credits Semester 4	16		Total Credits Semester 4	16

EE B.S. Curriculum			CpE B.S. Curriculum			CS B.S. Curriculum		
Number	Course Title	Cr.	Number	Course Title	Cr.	Number	Course Title	Cr.
EECE 305	Fundamentals of Electromagnetics	3	EECE 305	Fundamentals of Electromagnetics	3	CSCI 341	Theory of Computation	3
EECE 306	Fundamentals of Electromagnetics Lab	1	EECE 306	Fundamentals of Electromagnetics L.	1	CSCI 401	Operating Systems	3
EECE 309	Fund. of Electronics and SS Devices	3	EECE 309	Fund. of Electronics and SS Devices	3	CSCI 470	Fundamentals of Alg.	3
EECE 312	Fundamentals of Electronics and SS Devices Lab	1	EECE 312	Fundamentals of Electronics and SS Devices Lab	1	CSCI 450	Data Communications and Network Programming	3
EECE 331	Probability and Random Variables	3	EECE 331	Probability and Random Variables	3	CSCI 453	Intro to Cybersecurity	3
	Humanities Elective	3	EECE 406	Advanced Digital Systems	3			
PHED xxx	Physical Ed./ROTC	1	EECE 412	Advanced Digital Systems Lab	1			
	Total Credits Semester 5	15		Total Credits Semester 5	15		Total Credits Semester 5	15
EECE 333	Fundamentals of Signals and Systems	3	EECE 333	Fundamentals of Signals and Systems	3	CSCI 350	Structure of Programming Languages	3
EECE 325	Fundamentals of Energy Systems	3		Computer Engineering Elective	3		Technical Elective	3
EECE 326	Fundamentals of Energy Systems Lab	1	MATH 181	Discrete Structures	3	CSCI 211	Database Systems	3
	Engineering Science Elective	3	CSCI 201	Computer Organization I	3	MATH 180	Intro to Linear Algebra	3
EECE 320	Research in Undergraduate Experience	1	EECE 320	Research in Undergraduate Experience	1	ENGL 009	Technical Writing	3
	African American Studies Elective	3	ECON 001	Principles of Economics	3			
	Total Credits Semester 6	14		Total Credits Semester 6	16		Total Credits Semester 6	15
	Electrical Engineering Elective	3	EECE 416	Microcomputer Design	3	CSCI 363	Large Scale Programming	3
	Electrical Engineering Elective	3		Computer Engineering Elective	3		Applied Data Science	3
	Electrical Engineering Elective	3		Electrical Engineering Elective	3		Technical Elective	3
EECE 401	Senior Design I	3	EECE 401	Senior Design I	3	CSCI 491	Senior Project I	3
	Free Elective	3		Humanities Elective	3		Technical Elective	3
	Total Credits Semester 7	15		Total Credits Semester 7	16		Total Credits Semester 7	15
	Electrical Engineering Elective	3		Computer Engineering Elective	3		Technical Elective	3
	Electrical Engineering Elective	3		Electrical Engineering Elective	3		Technical Elective	3
	Electrical Engineering Elective	3		Social Science Elective	3		Non-technical Elective	3
EECE 404	Senior Design II	3	EECE 404	Senior Design II	3	CSCI 492	Senior Project II	3
ECON 001	Principles of Economics	3					Non-technical Elective	3
	Total Credits Semester 8	15		Total Credits Semester 8	12		Total Credits Semester 8	15

[< Back to Departments](#)

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MEEG-445 Undergraduate Research I, 3 Credits

Analysis, design and/or experimentation in Instructor's area of interest.

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MEEG-990/991 Co-op Mechanical Engineering, 1-12 credits

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[< Back to Departments](#)

Course Descriptions CEE

Chemistry

CHEM-003. General Chemistry & Recitation, 4 credits. Deals with the fundamental principles of chemistry, the chemical and physical properties of the elements and their most common compounds, and methods of qualitative inorganic analysis. **Prerequisite:** Students required to take **CAR Math** have to satisfy that requirement before they will be able to enroll in this course.

CHEM-005. General Chemistry Laboratory, 1 credit. Designed to teach some of the techniques of chemical experimentation, illustrate some of the principles of chemical substances.

Civil and Environmental Engineering

EGPP-101. Introduction to Engineering, 2 credits. Provides information on engineering education, the engineering profession, and basic concepts and tools. Introduces the engineering design process and provides the opportunity for students to complete engineering design projects.

CIEG-104. Civil Engineering Software & Design, 3 credits. Civil engineering involves the planning, design, construction, and operation of facilities that support the quality of life for all people, from road networks to water treatment systems to buildings and their foundations. This course will utilize a variety of teaching and learning techniques to introduce students to the civil engineering discipline, including the concentration areas of transportation, environmental, water resources, structural, and geotechnical engineering. Students will work individually to conduct research on civil engineering topics and familiarize themselves with skills/tools needed for success in the field including the following: technical writing, MathCAD, and AutoCAD. By the end of the course, students will be able to:

1. Use MathLab, MathCAD and AutoCAD to complete basic engineering analyses and design.
2. Identify and describe the civil engineering disciplines.
3. Prepare and deliver effective oral presentations.
4. Demonstrate technical writing competencies appropriate for civil engineering practice.

Prerequisite: EGPP-101

CIEG-202. Statics, 3 credits. Introduction to vectors, pseudo-graphical and analytical micro-computer aided resolution and composition of forces; equilibrium of collinear, concurrent, and non-concurrent two and three dimensional force systems, as applied to particles and rigid bodies. Coulomb friction; Hooke's law; introductory application of equilibrium, compatibility, and constitutive relations in the determination of forces moments, displacements and rotations of simple deformable bodies and biomechanical systems, using simple computer aids. **Prerequisite: MATH-157, PHYS-013.**

CIEG-207. Introduction to Environmental Engineering, 3 credits. Introduces concepts in water supply, water and wastewater treatment, air quality, solid and hazardous waste management, and social and ethical considerations. Provides a brief history and background of environmental engineering.

Prerequisite: CHEM-003.

CIEG-301. Mechanics of Materials Lecture, 3 credits. Introductory analysis of tension, compression and shear; analysis of stress and strain; ties, shafts, beams and columns; related laboratory experiments and computer applications; introduction to structural analysis and design. **Prerequisite: MATH-159, CIEG-302, MEEG-309; Corequisite: CIEG-303.**

CIEG-302. Dynamics, 3 credits. Study of motions of particles; particle systems, rigid bodies and simple deformable mass system; rectilinear and curvilinear kinematics; Newton's laws of motion and gravitation; work energy and impulse-momentum principles; conservation laws for energy and momentum; introduction to vibrations; computer-aided applications. **Prerequisite: CIEG-202; Corequisite: MATH-159.**

CIEG-303. Mechanics of Materials Lab, 1 credit. This laboratory course accompanies the Mechanics of Materials lecture. **Corequisite: CIEG-301 or approval of instructor**

CIEG-311. Fluid Mechanics Lecture, 3 credits. Theoretical and laboratory studies of fluid properties, hydrostatics, kinematics, and dynamics of fluid; continuity equation; energy and Bernoulli equation; momentum equation; dimensional analysis and flow resistance. **Prerequisite: MATH-158, CIEG-302; PHYS-013; Corequisite: CIEG-313**

CIEG-313. Fluid Mechanics Lab, 1 credit. This laboratory course accompanies the Fluid Mechanics lecture. CIEG 311. **Prerequisite: MATH-158, CIEG-302; PHYS-013; Corequisite: CIEG-311 or approval of instructor**

CIEG 314. Basic Structural Analysis, 3 credits. An introduction to the elastic behavior of structural elements, statically determinate structures; and reactions, shears, moments, and deflections in beams, trusses, and frames and definition of standard structural engineering loads. **Prerequisite: CIEG-301.**

CIEG-328. Unit Operations in Environmental Engineering, 3 credits. Analysis and basic design of treatment facilities for the remediation of air, water and land pollution. **Prerequisite: CIEG-207.**

CIEG-354 Engineering Economics, 3 credits . Examines principles of accounting, time value of money, depreciation, taxes, retirement, and economic analysis of alternatives for use in personal finances and engineering projects. **Prerequisite: MATH-157. {Note: replaces Engineering Systems Analysis}**

CIEG-351. Probability and Statistics, 3 credits. Stochastic and deterministic statistical modeling: probability and statistics for univariate analysis including probability density functions, confidence intervals and hypothesis testing. Probability and statistics for multivariate analysis including regression analysis, confidence intervals and hypothesis testing; PCA, ANOVA, and risk-based design concepts. **Prerequisite: MATH-158.**

CIEG-352. Water Resources Engineering I, 3 credits. Classical and statistical hydrology: hydrologic cycle, hydrologic processes, physical watershed characteristics, hydrologic modeling, collect analyze and interpret meteorological and hydrologic data using statistical analysis for design of hydrologic and hydraulic structures. Remote sensing data in hydrology. **Prerequisite: CIEG-351.**

CIEG-400. Special Topics in Civil Engineering, 3 credits. Presentation of material not normally available in regular course offerings or offering of new courses on a trial basis. Content determined by faculty member in consultation with the Department Chair.

CIEG-407. Intelligent Transportation Systems, 3 credits. Command, controls and communications in modern multimodal transportation; infrastructure/highway and vehicle automation, advanced traffic management, vehicle control and safety systems; information data, and sensory requirements; practical application. **Prerequisite:** CIEG-416, CIEG-465.

CIEG-416. Transportation Engineering, 3 credits. Involves planning and design of highways. Students work in teams during the preparation of the required design plans, cost estimates and project reports. **Prerequisite:** CIEG-104; **Co-req.:** CIEG-354.

CIEG-420. Matrix Structural Analysis, 3 credits. Continuation of analysis of statically indeterminate structures; moment distribution; introduction to matrix formulation of the direct stiffness method (emphasized) and the flexibility method (for reference); elementary finite element analysis techniques; introduction to nonlinear (plastic) analysis; structural stability; and structural dynamics. **Prerequisite:** CIEG-419.

CIEG-422. Steel Design, 3 credits. Principles of structural design, loads, types of steels, tension members, columns, non-composite and composite beams, beam-columns, column base plates, and simple bolted and welded connections. The use of the AISC LRFD specification is emphasized and a comprehensive group design project is assigned. **Prerequisite:** CIEG-314.

CIEG-433. Foundations, 3 credits. Based on the principles of soil mechanics, fluid mechanics, and solid mechanics, covers the bearing capacity and settlement analysis of shallow and mat foundations, an introduction to deep foundations, and design of earth retaining structures. Analytical, empirical, and computational methods are used. **Prerequisite:** CIEG-434.

CIEG-434. Soil Mechanics Lecture, 3 credits. Provides for appreciation and understanding of the engineering properties of soils and how they relate to design and construction, including soil identification and classification. **Prerequisite:** CIEG-301, CIEG-311; **Corequisite:** CIEG-438.

CIEG-435. Reinforced Concrete, 3 credits. Theory and design of reinforced concrete structural members and entire structural systems according to the ACI Building Code Requirements. The students will apply fundamentals and basic design procedures to reinforced concrete members (beams, slabs, columns and footings). **Prerequisite:** CIEG-314.

CIEG-438. Soil Mechanics Lab, 1 credit. This laboratory course accompanies the Soil Mechanics lecture. Example tests are permeability, shear strength, and consolidation. **Corequisite:** CIEG-434 or instructor approval.

CIEG-439. Senior Design I, 3 credits. This course is concerned with the planning, management, teaming and the development of the concept documents of the capstone design project. **Prerequisite:** CIEG-104, 207; CIEG-305; CIEG-352; CIEG-416; CIEG-434.

CIEG-440. Water and Wastewater Treatment, 3 credits. Advanced design of facilities for water and wastewater treatment including design ranges, regulations, economics and ethics of environmental design.

Prerequisite: CIEG-328.

CIEG-441. Senior Design II, 3 credits. This course integrates the many sub-disciplines of civil engineering for the concept documents provided in Senior Design I into developed engineering design documents. The process passes through the various phase of design development and ends with the production of a detailed design for the project. The course culminates with a formal presentation of the design and associated lessons learned to faculty and other professionals. **Prerequisite:** CIEG-439.

CIEG-442. Advanced Foundations, 3 credits. Case histories are presented to illustrate typical design and construction problems. Further coverage includes deep foundations and soil exploration and improvement techniques. Focus is placed on behavior, which departs from traditional foundation design expectations. **Prerequisite: CIEG-433.**

CIEG-445. Undergraduate Research, 3 credits. Requires a student to conduct research under the directives of an instructor. Students must seek and receive the approval of the instructor prior to enrollment in this course. The selected research topic must broaden the student's understanding of one of the five emphasis areas. **Prerequisite: CIEG-351**

CIEG-457. Advanced Hydrology, 3 credits. Modeling of the hydrologic cycle and hydrologic processes; learn and apply hydrologic models such as those hosted by the Watershed Modeling System (WMS) software, including the US Army Corps of Engineers HEC-1 model and the SCS TR-20 and TR-55 models; learn and apply GIS software, Arc GIS. **Prerequisite: CIEG-352.**

CIEG-462. Seminar, 1 credit. Forum for presentation of current topics of interest in civil engineering by individuals from industry, government and practice. **Prerequisite: CIEG-439; Co-req.: CIEG-441.**

CIEG-463. Water Resources Planning, 3 credits. Presents basic concepts in the planning of water resources development systems; analytical techniques, basic information required for planning; and examples for planning flood control, wastewater management, and water supply systems. **(Senior Status)**

CIEG-464. Engineering Project Management, 3 credits. Involves planning performing and controlling of engineering projects; introduces management roles, project scheduling, principles and procedures, as well as project proposal writing. **Prerequisite: CIEG-354 or equivalent.**

CIEG-465. Traffic Engineering I, 3 credits. Involves the collection and use of traffic engineering data and introduces students to traffic operations and safety. Students use software for capacity analysis and signal optimization. Students are required to prepare reports. **Prerequisite: CIEG-351; CIEG-416.**

CIEG-466. Traffic Engineering II, 3 credits. Involves the introduction to traffic impact analysis, and use of traffic simulation models for evaluating traffic operation on highway networks, including traffic impact studies and signal warrant analyses. **Prerequisite: CIEG-465.**

Comprehensive Sciences

COMP-001. Life Sciences Lecture & Laboratory, 3 Credits. This course explores the basic concepts of the biological (life) sciences. These concepts will be presented through the examination of the principal characteristics that all living things (life forms) have in common (i.e., ecology, genetics, taxonomy, metabolism, evolution, reproduction and development, etc.). The lecture information surveys living systems

on the chemical, cellular and organismal levels. The exploration is complemented by key laboratory applications and observations that will enable the students to recognize, comprehend and appreciate the complexities of biological organization that exist in nature. **Note: Students must register for the Lecture and Lab.**

COMP-002. Planetary Science Lecture & Laboratory, 3 Credits. The planetary science course involves studies of astronomy (planets, stars, the universe) and geology (the earth). In geology, the principal features of planet earth such as size, shape, composition, motions are presented. How planet earth changes as a result of internal and external forces act on it provides a topic of interest. In astronomy, emphasis is on the other planets, the solar system and other celestial bodies that exist in the universe. Laboratory investigations involve the examination of various samples, planetarium visits and field trips to area geological sites and venues where advanced technological telescopes can be used. **Note: Students must register for the Lecture and Lab.**

English

Note - Each student must complete the minimum requirement of six (6) credit hours in English as follows:

ENGL-002. Freshmen Composition I, 3 credits . Designed to develop the student's ability to express ideas clearly and effectively in writing and to read with perception and accuracy; emphasizes the power and value of written communication by reading exemplary text.

ENGL-003. Freshmen Composition II, 3 credits. Intended to increase the student's ability to write effectively, to read critically, and to present ideas logically. **Prerequisite: ENGL-002.**

Mathematics

MATH-156. Calculus I, 4 credits. Limits, continuity, and the derivative and integral of functions of one variable, with applications.

MATH-157. Calculus II, 4 credits. Continuation of MATH-156, including more integration, sequences, series, Taylor's theorem, improper integrals, and L'Hospital's rule. **Prerequisite: MATH 156.**

MATH-158. Calculus III, 4 credits. Continuation of MATH-157, including calculus of functions of several variables, with applications. **Prerequisite: MATH-157.**

MATH-159. Differential Equations, 4 credits. Elementary techniques of solving ordinary differential equations, including slope fields, equilibrium, separation of variables, linear differential equations, homogeneous differential equations, undetermined coefficients, bifurcations, power series, Laplace transforms, systems, and numerical methods. **Prerequisite: MATH-157.**

MATH 164. Introduction to Numerical Analysis. 3 crs. Treats numerical integration and numerical solution of differential equations, numerical linear algebra, matrix inversion, characteristic values; error propagation; and stability. **Prerequisite: CIEG-103; Corequisite: MATH-159.**

Mechanical Engineering

MEEG 209. Materials Science, 3 credits. Correlation of the structure of metals, ceramics, and organic materials with their mechanical and physical properties, control of properties by modifying the microstructure, and stability of materials in service environments. **Prerequisite: CHEM-003; PHYS 014.**

Physics

PHYS-013. Physics for Science and Engineering Lecture I, 3 credits. This lecture/recitation calculus-based course deals with mechanics, heat and sound. **Prerequisite: MATH-156; Corequisite: PHYS-023.**

PHYS-023 Physics for S&E Lab I, 1 credit. Laboratory course to accompany introductory physics course, **Corequisite: PHYS-013.**

PHYS-014. Physics for Science and Engineering Lecture II, 3 credits. This lecture and recitation calculus-based course covers electricity and magnetism, light and optics. **Prerequisite: PHYS-013, MATH 157; Corequisite: PHYS-023.**

PHYS-024 Physics for S&E Lab II, 1 credit. Laboratory course to accompany introductory physics course, PHYS-023.

[< Back to Departments](#)

Course Descriptions CEE

Chemistry

CHEM-003. General Chemistry & Recitation, 4 credits. Deals with the fundamental principles of chemistry, the chemical and physical properties of the elements and their most common compounds, and methods of qualitative inorganic analysis. **Prerequisite:** Students required to take **CAR Math** have to satisfy that requirement before they will be able to enroll in this course.

CHEM-005. General Chemistry Laboratory, 1 credit. Designed to teach some of the techniques of chemical experimentation, illustrate some of the principles of chemical substances.

Civil and Environmental Engineering

EGPP-101. Introduction to Engineering, 2 credits. Provides information on engineering education, the engineering profession, and basic concepts and tools. Introduces the engineering design process and provides the opportunity for students to complete engineering design projects.

CIEG-104. Civil Engineering Software & Design, 3 credits. Civil engineering involves the planning, design, construction, and operation of facilities that support the quality of life for all people, from road networks to water treatment systems to buildings and their foundations. This course will utilize a variety of teaching and learning techniques to introduce students to the civil engineering discipline, including the concentration areas of transportation, environmental, water resources, structural, and geotechnical engineering. Students will work individually to conduct research on civil engineering topics and familiarize themselves with skills/tools needed for success in the field including the following: technical writing, MathCAD, and AutoCAD. By the end of the course, students will be able to:

1. Use MathLab, MathCAD and AutoCAD to complete basic engineering analyses and design.
2. Identify and describe the civil engineering disciplines.
3. Prepare and deliver effective oral presentations.
4. Demonstrate technical writing competencies appropriate for civil engineering practice.

Prerequisite: EGPP-101

CIEG-202. Statics, 3 credits. Introduction to vectors, pseudo-graphical and analytical micro-computer aided resolution and composition of forces; equilibrium of collinear, concurrent, and non-concurrent two and three dimensional force systems, as applied to particles and rigid bodies. Coulomb friction; Hooke's law; introductory application of equilibrium, compatibility, and constitutive relations in the determination of forces moments, displacements and rotations of simple deformable bodies and biomechanical systems, using simple computer aids. **Prerequisite: MATH-157, PHYS-013.**

CIEG-207. Introduction to Environmental Engineering, 3 credits. Introduces concepts in water supply, water and wastewater treatment, air quality, solid and hazardous waste management, and social and ethical considerations. Provides a brief history and background of environmental engineering.

Prerequisite: CHEM-003.

CIEG-301. Mechanics of Materials Lecture, 3 credits. Introductory analysis of tension, compression and shear; analysis of stress and strain; ties, shafts, beams and columns; related laboratory experiments and computer applications; introduction to structural analysis and design. **Prerequisite: MATH-159, CIEG-302, MEEG-309; Corequisite: CIEG-303.**

CIEG-302. Dynamics, 3 credits. Study of motions of particles; particle systems, rigid bodies and simple deformable mass system; rectilinear and curvilinear kinematics; Newton's laws of motion and gravitation; work energy and impulse-momentum principles; conservation laws for energy and momentum; introduction to vibrations; computer-aided applications. **Prerequisite: CIEG-202; Corequisite: MATH-159.**

CIEG-303. Mechanics of Materials Lab, 1 credit. This laboratory course accompanies the Mechanics of Materials lecture. **Corequisite: CIEG-301 or approval of instructor**

CIEG-311. Fluid Mechanics Lecture, 3 credits. Theoretical and laboratory studies of fluid properties, hydrostatics, kinematics, and dynamics of fluid; continuity equation; energy and Bernoulli equation; momentum equation; dimensional analysis and flow resistance. **Prerequisite: MATH-158, CIEG-302; PHYS-013; Corequisite: CIEG-313**

CIEG-313. Fluid Mechanics Lab, 1 credit. This laboratory course accompanies the Fluid Mechanics lecture. CIEG 311. **Prerequisite: MATH-158, CIEG-302; PHYS-013; Corequisite: CIEG-311 or approval of instructor**

CIEG 314. Basic Structural Analysis, 3 credits. An introduction to the elastic behavior of structural elements, statically determinate structures; and reactions, shears, moments, and deflections in beams, trusses, and frames and definition of standard structural engineering loads. **Prerequisite: CIEG-301.**

CIEG-328. Unit Operations in Environmental Engineering, 3 credits. Analysis and basic design of treatment facilities for the remediation of air, water and land pollution. **Prerequisite: CIEG-207.**

CIEG-354 Engineering Economics, 3 credits . Examines principles of accounting, time value of money, depreciation, taxes, retirement, and economic analysis of alternatives for use in personal finances and engineering projects. **Prerequisite: MATH-157. {Note: replaces Engineering Systems Analysis}**

CIEG-351. Probability and Statistics, 3 credits. Stochastic and deterministic statistical modeling: probability and statistics for univariate analysis including probability density functions, confidence intervals and hypothesis testing. Probability and statistics for multivariate analysis including regression analysis, confidence intervals and hypothesis testing; PCA, ANOVA, and risk-based design concepts. **Prerequisite: MATH-158.**

CIEG-352. Water Resources Engineering I, 3 credits. Classical and statistical hydrology: hydrologic cycle, hydrologic processes, physical watershed characteristics, hydrologic modeling, collect analyze and interpret meteorological and hydrologic data using statistical analysis for design of hydrologic and hydraulic structures. Remote sensing data in hydrology. **Prerequisite: CIEG-351.**

CIEG-400. Special Topics in Civil Engineering, 3 credits. Presentation of material not normally available in regular course offerings or offering of new courses on a trial basis. Content determined by faculty member in consultation with the Department Chair.

CIEG-407. Intelligent Transportation Systems, 3 credits. Command, controls and communications in modern multimodal transportation; infrastructure/highway and vehicle automation, advanced traffic management, vehicle control and safety systems; information data, and sensory requirements; practical application. **Prerequisite:** CIEG-416, CIEG-465.

CIEG-416. Transportation Engineering, 3 credits. Involves planning and design of highways. Students work in teams during the preparation of the required design plans, cost estimates and project reports. **Prerequisite:** CIEG-104; **Co-req.:** CIEG-354.

CIEG-420. Matrix Structural Analysis, 3 credits. Continuation of analysis of statically indeterminate structures; moment distribution; introduction to matrix formulation of the direct stiffness method (emphasized) and the flexibility method (for reference); elementary finite element analysis techniques; introduction to nonlinear (plastic) analysis; structural stability; and structural dynamics. **Prerequisite:** CIEG-419.

CIEG-422. Steel Design, 3 credits. Principles of structural design, loads, types of steels, tension members, columns, non-composite and composite beams, beam-columns, column base plates, and simple bolted and welded connections. The use of the AISC LRFD specification is emphasized and a comprehensive group design project is assigned. **Prerequisite:** CIEG-314.

CIEG-433. Foundations, 3 credits. Based on the principles of soil mechanics, fluid mechanics, and solid mechanics, covers the bearing capacity and settlement analysis of shallow and mat foundations, an introduction to deep foundations, and design of earth retaining structures. Analytical, empirical, and computational methods are used. **Prerequisite:** CIEG-434.

CIEG-434. Soil Mechanics Lecture, 3 credits. Provides for appreciation and understanding of the engineering properties of soils and how they relate to design and construction, including soil identification and classification. **Prerequisite:** CIEG-301, CIEG-311; **Corequisite:** CIEG-438.

CIEG-435. Reinforced Concrete, 3 credits. Theory and design of reinforced concrete structural members and entire structural systems according to the ACI Building Code Requirements. The students will apply fundamentals and basic design procedures to reinforced concrete members (beams, slabs, columns and footings). **Prerequisite:** CIEG-314.

CIEG-438. Soil Mechanics Lab, 1 credit. This laboratory course accompanies the Soil Mechanics lecture. Example tests are permeability, shear strength, and consolidation. **Corequisite:** CIEG-434 or instructor approval.

CIEG-439. Senior Design I, 3 credits. This course is concerned with the planning, management, teaming and the development of the concept documents of the capstone design project. **Prerequisite:** CIEG-104, 207; CIEG-305; CIEG-352; CIEG-416; CIEG-434.

CIEG-440. Water and Wastewater Treatment, 3 credits. Advanced design of facilities for water and wastewater treatment including design ranges, regulations, economics and ethics of environmental design.

Prerequisite: CIEG-328.

CIEG-441. Senior Design II, 3 credits. This course integrates the many sub-disciplines of civil engineering for the concept documents provided in Senior Design I into developed engineering design documents. The process passes through the various phase of design development and ends with the production of a detailed design for the project. The course culminates with a formal presentation of the design and associated lessons learned to faculty and other professionals. **Prerequisite:** CIEG-439.

CIEG-442. Advanced Foundations, 3 credits. Case histories are presented to illustrate typical design and construction problems. Further coverage includes deep foundations and soil exploration and improvement techniques. Focus is placed on behavior, which departs from traditional foundation design expectations. **Prerequisite: CIEG-433.**

CIEG-445. Undergraduate Research, 3 credits. Requires a student to conduct research under the directives of an instructor. Students must seek and receive the approval of the instructor prior to enrollment in this course. The selected research topic must broaden the student's understanding of one of the five emphasis areas. **Prerequisite: CIEG-351**

CIEG-457. Advanced Hydrology, 3 credits. Modeling of the hydrologic cycle and hydrologic processes; learn and apply hydrologic models such as those hosted by the Watershed Modeling System (WMS) software, including the US Army Corps of Engineers HEC-1 model and the SCS TR-20 and TR-55 models; learn and apply GIS software, Arc GIS. **Prerequisite: CIEG-352.**

CIEG-462. Seminar, 1 credit. Forum for presentation of current topics of interest in civil engineering by individuals from industry, government and practice. **Prerequisite: CIEG-439; Co-req.: CIEG-441.**

CIEG-463. Water Resources Planning, 3 credits. Presents basic concepts in the planning of water resources development systems; analytical techniques, basic information required for planning; and examples for planning flood control, wastewater management, and water supply systems. **(Senior Status)**

CIEG-464. Engineering Project Management, 3 credits. Involves planning performing and controlling of engineering projects; introduces management roles, project scheduling, principles and procedures, as well as project proposal writing. **Prerequisite: CIEG-354 or equivalent.**

CIEG-465. Traffic Engineering I, 3 credits. Involves the collection and use of traffic engineering data and introduces students to traffic operations and safety. Students use software for capacity analysis and signal optimization. Students are required to prepare reports. **Prerequisite: CIEG-351; CIEG-416.**

CIEG-466. Traffic Engineering II, 3 credits. Involves the introduction to traffic impact analysis, and use of traffic simulation models for evaluating traffic operation on highway networks, including traffic impact studies and signal warrant analyses. **Prerequisite: CIEG-465.**

Comprehensive Sciences

COMP-001. Life Sciences Lecture & Laboratory, 3 Credits. This course explores the basic concepts of the biological (life) sciences. These concepts will be presented through the examination of the principal characteristics that all living things (life forms) have in common (i.e., ecology, genetics, taxonomy, metabolism, evolution, reproduction and development, etc.). The lecture information surveys living systems

on the chemical, cellular and organismal levels. The exploration is complemented by key laboratory applications and observations that will enable the students to recognize, comprehend and appreciate the complexities of biological organization that exist in nature. **Note: Students must register for the Lecture and Lab.**

COMP-002. Planetary Science Lecture & Laboratory, 3 Credits. The planetary science course involves studies of astronomy (planets, stars, the universe) and geology (the earth). In geology, the principal features of planet earth such as size, shape, composition, motions are presented. How planet earth changes as a result of internal and external forces act on it provides a topic of interest. In astronomy, emphasis is on the other planets, the solar system and other celestial bodies that exist in the universe. Laboratory investigations involve the examination of various samples, planetarium visits and field trips to area geological sites and venues where advanced technological telescopes can be used. **Note: Students must register for the Lecture and Lab.**

English

Note - Each student must complete the minimum requirement of six (6) credit hours in English as follows:

ENGL-002. Freshmen Composition I, 3 credits . Designed to develop the student's ability to express ideas clearly and effectively in writing and to read with perception and accuracy; emphasizes the power and value of written communication by reading exemplary text.

ENGL-003. Freshmen Composition II, 3 credits. Intended to increase the student's ability to write effectively, to read critically, and to present ideas logically. **Prerequisite: ENGL-002.**

Mathematics

MATH-156. Calculus I, 4 credits. Limits, continuity, and the derivative and integral of functions of one variable, with applications.

MATH-157. Calculus II, 4 credits. Continuation of MATH-156, including more integration, sequences, series, Taylor's theorem, improper integrals, and L'Hospital's rule. **Prerequisite: MATH 156.**

MATH-158. Calculus III, 4 credits. Continuation of MATH-157, including calculus of functions of several variables, with applications. **Prerequisite: MATH-157.**

MATH-159. Differential Equations, 4 credits. Elementary techniques of solving ordinary differential equations, including slope fields, equilibrium, separation of variables, linear differential equations, homogeneous differential equations, undetermined coefficients, bifurcations, power series, Laplace transforms, systems, and numerical methods. **Prerequisite: MATH-157.**

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Mechanical Engineering

MEEG 209. Materials Science, 3 credits. Correlation of the structure of metals, ceramics, and organic materials with their mechanical and physical properties, control of properties by modifying the microstructure, and stability of materials in service environments. **Prerequisite: CHEM-003; PHYS 014.**

Physics

PHYS-013. Physics for Science and Engineering Lecture I, 3 credits. This lecture/recitation calculus-based course deals with mechanics, heat and sound. **Prerequisite: MATH-156; Corequisite: PHYS-023.**

PHYS-023 Physics for S&E Lab I, 1 credit. Laboratory course to accompany introductory physics course, **Corequisite: PHYS-013.**

PHYS-014. Physics for Science and Engineering Lecture II, 3 credits. This lecture and recitation calculus-based course covers electricity and magnetism, light and optics. **Prerequisite: PHYS-013, MATH 157; Corequisite: PHYS-023.**

PHYS-024 Physics for S&E Lab II, 1 credit. Laboratory course to accompany introductory physics course, PHYS-023.

[< Back to Home](#)

ECE Course Descriptions

Electrical and Computer Engineering (ECE) Course Descriptions

EGPP-101 - Introduction to Engineering, 2 Credits

Provides information on engineering education, the engineering profession, and basic concepts and tools. Introduces the engineering design process and provides opportunity for students to complete engineering design projects.

Prerequisite: None

Course Offering: Fall Semester

EECE-102 - Intro to Elec & Comp Eng, 1 Credit

Continuation of EGPP-101 as related to the electrical and computer engineering profession. Organized in to five Blocks: Descriptive, Environment, Technical, Practical (Hands on), and Projects, students are introduced to various engineering issues related to the profession of electrical and computer engineering. Historical perspectives and Electrical Engineering Education/Profession and Design are reviewed. Ethics, social/environmental/cultural/religious issues facing electrical engineers in a global work environment are discussed. An overview of electrical engineering discipline and five major classifications of electrical systems in communication, computer, control, power, and signal processing are presented. Technical aspects and safety considerations of a typical electrical engineering laboratory are introduced. A capstone term project requires assembling an electrical system (e.g., a robot kit) and its study and presentation from a systems point of view.

Prerequisite: EGPP-101

Course Offering: Spring Semester

EECE-156 - Math I Lab, 1 Credit

The purpose of this course is to develop students' problem solving skills, and improve their understanding of the calculus techniques and concepts they learn in Math 156 (Calculus I). Topics include: Algebra Review, Limits, Continuity, Derivative: definition, rules: sum, quotient, product, power, chain, Implicit Differentiation, Applications of the Derivative: related rates, max/min problems, L'Hospital's Rule, Anti-derivative, Integration.

Corequisite: MATH-156

Course Offering: Fall Semester, Spring Semester

EECE-157 - Math Lab II, 1 Credit

The purpose of this course is to further develop students' problem solving skills, improve their understanding of the calculus techniques and concepts they learn in Math 157 (Calculus II), and help them see how calculus can be used to solve engineering problems. Topics include: integration techniques, applications of integration, polar functions and parametric functions, sequences and series.

Prerequisite: MATH-156

Corequisite: MATH-157

Course Offering: Fall Semester, Spring Semester

EECE-158 - Math Lab III, 1 Credit

The purpose of this course is to further develop students' problem solving skills, improve their understanding of the calculus techniques and concepts they learn in Math 158 (Calculus III), and help them see how calculus can be used to solve engineering problems. Topics include: Vectors and scalars, Dot and Cross Product, Vector Differentiation, Gradient, Divergence, and Curl, Vector Integration, Divergence Theorem, and Stokes' Theorem.

Prerequisite: MATH-157

Corequisite: MATH-158

Course Offering: Fall Semester

EECE-160 - Engineering Math, 3 Credits

Course introduction; history and importance of engineering Mathematics, trigonometry in engineering, 2-D vectors in engineering, complex numbers in engineering, 3-D vectors in engineering, systems of equations in engineering, application of derivatives in engineering, application of integrals in engineering, solving differential equation, applications of differential equations in engineering, Laplace transforms and applications, Interdisciplinary Applications.

Prerequisite: MATH-157

Course Offering: Spring Semester

EECE-203 - Fundamentals of Circuit Theory, 4 Credits

Understanding of basic circuit theory, circuit theorems, dc, ac circuits, magnetic circuits, transients, Laplace and Fourier transforms, Fourier series, electric devices, 2-port network, basic filters and op-amps.

Prerequisites: PHYS-014, PHYS-024

Corequisite: EECE-209

Course Offering: Spring Semester

EECE-209 - Fundamentals of Circuit Theory Lab, 1 Credit

Understanding of hands-on labs associated basic circuit theory, circuit theorems, dc, ac circuits, operational amplifiers (op-amps), electric devices network, basic filters and op-amps.

Prerequisites: PHYS-014, PHYS-024

Co-requisite: EECE-203

Course Offering: Spring Semester

EECE-212 - Fundamentals of Digital Systems, 3 Credits

Introduction to hardware building blocks used in digital computers and systems. Introduces number systems (including binary, octal and hexadecimal), Boolean algebra, two-level/multilevel logic minimization/simplification using K-Maps and Quine-McCluskey methods, combinational logic circuit design and implementation with available SSI, MSI, and programmable logic devices (PAL, PLA, multiplexers, encoders, ROMs). Practical considerations such as hazard and glitches are treated. Basics of sequential logic design including latches, flip-flops, registers, counters, finite state machines design, minimization, and implementation are presented.

Prerequisite: Sophomore Standing

Corequisite: EECE-217

Course Offering: Spring Semester

EECE-218 - Fund of Digital Systems Lab, 1 Credit

Laboratory experiments and (mini) projects in design and implementation of simplex to moderately complex combinational and sequential logic circuits provide a practical understanding of concepts covered

in EECE-212. Project(s) introduce students to design with programmable logic devices and logic design/simulation software such as Electronics Workbench.

Prerequisite: Sophomore Standing

Corequisite: EECE-212

Course Offering: Spring Semester

EECE-260 - Eng. Programming & Application, 3 Credits

Use basic applications in engineering to bring up the major concepts, methods and techniques needed to perform successful computation. The course includes complexity, testing and debugging, binary search, divide and conquer, dynamic programming, application to statistics and Monte Carlo simulations.

Prerequisite: CSCI-135

Course Offering: Spring Semester

EECE-305 - Fund: Electromagnetics, 3 Credits

Electric fields, flux and potential; Coulomb's Poisson's and Gauss's laws; permittivity and conductivity, magnetostatics, magnetic materials, magnetic materials and forces, Biot-Savart law and time varying fields, Maxwell's equations in integral and differential forms, time-domain analysis of waves. Application of electromagnetic theory to transmission lines.

Prerequisite: MATH-158, PHYS-014

Course Offering: Fall Semester

EECE-306 - Fund: Electromagnetics Lab, 1 Credits

To provide ECE majors with a firm basis for an understanding of the electrical circuits, the radiation, propagation, and transmission of electric power, as well as the electromagnetic storage systems.

Prerequisite:

Corequisite: EECE-305

Course Offering: Fall Semester

EECE-309 - Fundamentals of Electronics & SS Devices, 3 Credits

Understanding of basic semiconductors devices, characteristics, switching and basic amplifiers, operational amplifiers, frequency response, filters, wave generation, introduction to power electronics, team work.

Prerequisite: EECE-203

Corequisite: EECE-312

Course Offering: Fall Semester

EECE-310 - Principles of Electronics, 2 Credits

This course is open to non-EE and non-CpE students only. The course covers theoretical and practical fundamental principles of electronic devices, circuits and instruments.

Prerequisites: MATH-159, PHYS-014

Course Offering: Fall Semester, Spring Semester

EECE-312 - Fundamentals: Elec & SS Devices Lab, 1 Credit

Understanding of basic semiconductors devices, characteristics, switching and basic amplifiers, operational amplifiers, frequency response, filters, wave generation, introduction to power electronics, team work

Prerequisite: EECE-209

Corequisite: EECE-309

Course Offering: Fall Semester

EECE-320 - Research in Undergraduate Exp, 1 Credit

Research in Undergraduate Experience makes undergraduate students familiar with basics of research. Students practice research on a specific subject under supervision of a faculty member. Students perform literature review on their selected subject and discuss about it to the class. Through this effort, students become exposed to various subjects and understand the importance of and the need for research. The course teaches students how to present their work to others. It also emphasizes on long life learning. Further, students become familiar with LaTeX as a high-quality typesetting system used for the communication and publication of scientific documents.

Prerequisite: Junior Standing

Corequisite:

Course Offering: Spring Semester

EECE-325 - Fundamentals of Energy Systems, 3 Credits

This course focuses on the fundamentals of energy systems centered around electric power generation. Starting with the traditional system of large, central power stations connected to their customers by hundreds or thousands of miles of transmission lines, this course covers distributed, renewable, cleaner, smaller generation systems located closer to their loads. In that regard, while other generation sources such as Biomass and Fuel Cells are covered, wind power generation systems and photovoltaic (PV) power generation systems are highlighted in the course.

Prerequisite: EECE-203

Corequisite: EECE-326

Course Offering: Fall Semester

EECE-326 - Fundamentals of Energy Systems Lab, 1 Credits

This course focuses on the laboratory experiments of fundamentals of energy systems dealing with poly-phase power measurements, synchronous machines, transmission line, renewable electricity systems of induction motor/generator. Also emphasized is renewable energy system modeling tools and system development using the modeling tools.

Prerequisite:

Corequisite: EECE-325

Course Offering: Fall Semester

EECE-331 - Probability & Random Variables for Engineers, 3 Credits

Examines fundamentals of discrete and continuous probability: conditional probability, independence, random variables, density and distribution functions, expected value and variance, common discrete and continuous distributions, joint distributions, and introduction to simple stochastic processes. Applications to electrical and computer engineering; reliability of series and parallel circuits, models for waiting time phenomena.

Prerequisite: MATH-159 Course Offering: Fall Semester

EECE-333 - Fundamentals of Signals & Systems, 3 Credits

Design-based course introduces comprehensive treatment of basic signal theory in time and frequency domains. Discrete and continuous time cases are treated simultaneously, covers concepts of signals and systems, convolution of difference and differential systems, block diagrams, state-space realizations and solution, matrix theory, Fourier series, transform techniques (Fourier, FFT, Z and Laplace), frequency response and stability. Exercises include traditional homework problems, computer applications such as MATLAB, C and SIGSYS and hardware design (laboratory generation of various signals and application to

systems response) and design projects (Demonstration is required).

Prerequisite: EECE-331

Course Offering: Spring Semester

EECE-350 - Operating Systems for Engineers, 3 Credits

Fuses the history and evolution of operating systems, concepts of process management, memory addressing and allocation, files and protection, deadlocks and distributed systems.

Prerequisite: CSCI-135 or SYCS-135

Course Offering: Spring Semester

EECE-401 - Senior Design I, 3 Credits

Fundamentals of design principles, and engineering applications, design methodologies with emphasis on synthesis and evaluation, design process, reliability, the impact of engineering economy, report writing, ethics and alternative solutions will be discussed. During this course, students must identify a topic and an advisor for their Thesis Design Project. The project must be approved by the advisor and the course instructor.

Prerequisite:

Course Offering: Fall Semester, Spring Semester

EECE-404 - Senior Design II, 3 Credits

Enhances knowledge of engineering design principles to solve real world problems, project planning, analysis, simulation and presentation, economic impact, ethics synthesis. Design areas are selected from solid-state electronics, digital systems, communications (signal processing), power/energy systems and controls, power electronics, antennas and microwave and others. Oral presentation (with poster session) as well as written report required. Most of the semester will be devoted to the design and implementation of the Senior Thesis Project selected by student and approved by his/her advisor at the conclusion of EECE-401.

Prerequisite: EECE-401

Course Offering: Fall Semester, Spring Semester

EECE-405 - Energy Conversion II, 3 Credits

Deals with advanced steady state and transient analysis of electronic machines stability and control, and static converters and inverters.

Prerequisite: ELEG-403

Course Offering: TBA

EECE-406 - Advanced Digital Systems Design, 3 Credits

Consists of design, analysis, optimization, and implementation of complex sequential digital systems and finite state machines (FSM). Hardware description languages (HDL), VHDL and/or Verilog, are introduced and will be used to design and implement digital systems. The structure of a computer and its organization will be reviewed. Finite state machine of a Simple CPU will be developed and various implementation alternatives (FSM, time state, jump counters, and microprogramming) of its controller will be studied.

Prerequisite: EECE-212

Corequisite: EECE-412

Course Offering: Fall Semester

EECE-408 - Linear Control Systems, 3 Credits

Deals with analysis of time and frequency response of closed loop systems, block diagrams, signal flow

graphs, Mason gain, Routh-Hurwitz and Nyquist criteria for stability, root-locus method and system specifications, compensators, state variable methods, introduction to digital control.

Prerequisite: EECE-332

Corequisite:

Course Offering: Fall Semester

EECE-410 - Introduction to Computer Networks, 3 Credits

Presents basic concepts of data communication networking and computer communications architectures, including packet switching, local area networks, OSI (Open System Interconnection Architectures), TCP/IP, X.25/X.75, and SNA (System Network Architecture).

Prerequisite:

Course Offering: Spring Semester

EECE-412 - Advanced Digital Systems Design Laboratory, 1 Credit

Laboratory projects will use a PC-based Computer-Aided Design Tool environment that supports hardware description languages (HDL) such as VHDL and Verilog for design, simulation, and synthesis of logic systems. Early lab exercises (mini projects) will use SSI/MSI chips; then HDL-based design tools and associated methodologies will be introduced to design, simulate, and synthesize complex digital systems for implementation with Programmable Logic Devices and Field Programmable Gate Arrays (FPGA). Teams of two or three students will select and undertake design projects.

Prerequisite:

Co-requisite: EECE-406

Course Offering: Spring Semester

EECE-416 - Microcomputer Design, 3 Credits

Examines microprocessors, support architectures, and hardware/software. Also presents microprocessors' software model and programming, assembly language programming, microprocessor applications, microprocessor-based systems, and microcomputers. Projects will be used to introduce microprocessor applications.

Prerequisite: EECE-212

Course Offering: Fall Semester

EECE-420 - Introduction to VLSI Design, 3 Credits

Introduces CMOS technology and theory; CMOS circuit and digital logic design; layout rules and techniques; circuit characterization and performance estimation; CMOS subsystem design; VLSI systems design methods; VLSI CAD tools; laboratory experience in custom VLSI chip design on workstations using concepts in cell hierarchy; final project involving specification, design and evaluation of a VLSI chip or VLSI CAD program. Written report and oral presentation of the final project are required.

Prerequisites: EECE-211, EECE-308

Course Offering: Fall Semester

EECE-421 - Power Systems Analysis, 3 Credits

Covers one-line diagram per unit quantity, power generation and synchronous machines, transmission line theory, analysis of interconnected systems using load flow studies and computation techniques. Economic operation of power system. Design projects.

Prerequisite: EECE-325

Course Offering: Fall Semester

EECE-422 - Power Communications & Control, 3 Credits

Continuation of EECE-421. Introduction to telecommunication, fundamentals of communications, data representation and communication, power system and fault analysis, protection and controls, power system stability, communication protocol concepts and security and standards.

Prerequisite: EECE- 421

Course Offering: Spring Semester

EECE-453 - Communications Theory, 3 Credits

Includes probability theory, hypothesis testing, channel capacity, coding, detection and system performance analysis.

Prerequisite: EECE-331 or EECE-332

Course Offering: Fall Semester

EECE-456 - Embedded Systems Design Lab, 3 Credits

Project based course for design and system integration of embedded systems using microprocessor boards and I/O devices.

Prerequisite: EECE-416

Course Offering: Spring Semester

EECE-460 - Wireless Communication, 3 Credits

Presents the physical layer of wireless communication systems, implementation of speech coding, error control, modulation/demodulation and filtering schemes for wireless links using digital signal processors for base band functions.

Prerequisite: EECE-453

Course Offering: Spring Semester

EECE-479 - Cybersecurity for Net CPS/IoT, 3 Credits

This course is designed to introduce emerging topics related to cybersecurity challenges and practical cyber-defense/countermeasures in networked Cyber-Physical Systems (CPS) and Internet-of-Things (IoT). The course will cover fundamental concepts, technologies, theoretical understanding and practical basis for cybersecurity of networked CPS/IoT. Graduate students will complete an independent research project which involves a written and oral presentation not required at the undergraduate level.

Prerequisite:

Course Offering: Fall Semester

EECE-487 - Telecommunications, 3 Credits

Consists of telecommunications systems design for point-to-point and mass data distribution, modulation techniques, propagation modes and control methods.

Prerequisite: EECE-453

Course Offering: Spring Semester

EECE-495 - Signal Processing, 3 Credits

Presents sampling as a modulation process; aliasing; the sampling theorem; the Z-transform and discrete-time system analysis; direct and computer-aided design of recursive and non recursive digital filters; the Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT); digital filtering using the FFT; analog-to-digital and digital-to-analog conversion; effects of quantization and finite-word-length arithmetic, and design and implementation of these algorithms on Motorola family of Digital Signal Processor chips and/or other similar DSP chips.

Prerequisite: EECE-333

Course Offering: Fall Semester

EECE-496 - Integrated Circuits Tech Lab, 3 Credits

This laboratory course is to serve as a hands-on introduction to the environment, processes, and procedures that can be used in the processing of semiconductor materials, and fabrication of nanostructures. Processes that will be performed include lithography, metallization, materials characterization, etc. The evaluation procedures associated with each process will also be examined. Students will process semiconductor wafers resulting in the formation of actual device structures.

Prerequisite:

Corequisite:

Course Offering: Spring Semester

EECE-498 - Independent Project, 3 Credits

Study performed by individual student under faculty supervision.

Prerequisite: Departmental Approval

Course Offering: Fall Semester, Spring Semester

EECE-499 - Special Topics in Electrical Engineering, 3 Credits

Special courses not offered on a regular basis.

Prerequisite: Departmental approval

Course Offering: Fall Semester, Spring Semester

[< Back to Departments](#)

Course Descriptions ARCH

Course Categories

<i>Course Category</i>	<i>Number of Courses</i>	<i>Total Credit Hours</i>
General Education	7	19
General/Liberal Studies Elective (non-architecture courses)	5	15
Architecture Core Classes	28	110
Architecture Professional Electives	4	12
Open Electives (either architecture or non-architecture courses)	5	15
<i>TOTAL</i>	49	171

CORE COURSES

DESIGN STUDIOS

ARCH 160 Foundations in Design I (5 credits)

A studio course that introduces students to architectural representation. Orthographic projections, descriptive geometry, contours, paraline drawings, shade and shadows and model making are presented and applied.

PREREQUISITES: None

ARCH 161 Foundations in Design II (5 credits)

This course develops the techniques introduced in Foundations in Design I and introduces freehand/estimated perspective, presentation composition and basic rendering techniques.

PREREQUISITES: ARCH 160.

ARCH 199 Design I (6 credits)

This first course of the eight-semester design sequence develops principles of architecture in a studio setting. Projects explore notions of space definition, landscape intensification and transformation, space organization and elementary construction technologies.

PREREQUISITES: ARCH 100; ARCH 150 or ARCH 160; ARCH 151 or ARCH 161.

ARCH 200 Design II (6 credits)

Continuation of Design I. The level of complexity of the projects is increased. Issues of intention and image are introduced. Natural, suburban and urban sites are used to broaden student awareness of the environment. Ordering principles are related to function and to site conditions.

PREREQUISITES: ARCH 199.

ARCH 201 Design III (6 credits)

Reinforces the concepts introduced in Design I and II and explores the impact of function, structure, construction, site conditions and climate on architectural form. PREREQUISITES: ARCH 200.

ARCH 202 Design IV (6 credits)

Continuation of Design III. Explores the impact of programming function, structure construction site conditions, and the environment on architectural form.

PREREQUISITES: ARCH 201.

ARCH 203 Design V (6 credits)

Reinforces work of earlier design studios and explores issues of more complex building types and urban design. PREREQUISITES: ARCH 202; ARCH 502; ARCH 522; ARCH 651.

ARCH 204 Design VI (6 credits)

Continuation of Design V. Exploration of issues of more complex building types, urban design, and building design comprehensive needs. PREREQUISITES: ARCH 203; ARCH 951.

ARCH 860 Thesis I (6 credits)

Builds on work of previous design studios and emphasized exploration and development of architectural expression through integration of various aspects of architectural design within cultural and site contexts. PREREQUISITES: ARCH 206; ARCH 701 or ARCH 570, ARCH 891.

ARCH 861 Thesis II (6 credits)

The final design studios with emphasis on exploration and development of architectural expression through integration of various aspects of architectural design within cultural and site contexts. PREREQUISITES: ARCH 860 or ARCH 207; ARCH 701 or ARCH 570.

LECTURE COURSES**ARCH 100 Architecture Freshman Seminar (1 credit)**

A seminar course which introduces first year students to a range of areas of interest, expertise, and career paths within the architecture profession.

PREREQUISITES: None

ARCH 208 Design Thinking and Making (3 credits)

The course introduces students to the process of thoughtful design through investigation and making. The course is predicated on the concept that establishing a solid methodology on the practice of making and thinking in non-linear, abstract ways can facilitate the process of designing virtually anything. While every design challenge is unique, applying a deeper understanding of how to approach the question/s being asked is of paramount importance. This course focuses on how to approach an abstract idea and make it concrete by marrying the theories of conceptualization and investigation with the physical acts of making. The goal is to have students create a systematic methodology that can be applied to virtually all design challenges at every level of studio and beyond. The class will be comprised of lectures, readings, discussions and the application of ideas into physically made objects as well as training on special equipment, tools and software will form an integral part of the course.

PREREQUISITES: None.

ARCH 266 Architecture Pre-Design (3 credits)

Course focuses primarily on needs of students who are approaching design problems requiring a sequential structuring for analysis, synthesis and evaluation. The course covers micro to macro-environmental programming and design procedures. Considerable emphasis on development and use of appropriate communication skills with case studies.

PREREQUISITES: ARCH 199; Second year standing.

ARCH 270 Digital Tools in Architecture I (3 credits)

Introduces architecture students to computer applications to architecture. Provides computer literacy for both business and graphic computer applications and systems management.

PREREQUISITES: None.

ARCH 301 Architectural History Survey I (3 credits)

Principles of architectural history, the why and how of the study of history is presented in the context of early civilizations and their architecture. The course covers the beginning of work of the Arab-world, antiquity, late antiquity and post. Late antiquity persuades of Africa, Europe, Central Asia, Asia and pre-Columbian America. PREREQUISITES: ARCH 100; ARCH 150 or ARCH 160; ARCH 151 or ARCH 161.

ARCH 302 Architecture History Survey II (3 credits)

This course provides clear definitions and limits of the elements of architecture as they relate to socio-cultural systems conferring significance and noteworthiness to respective historical styles, from the post-renaissance period to the contemporary period. PREREQUISITES: ARCH 301.

ARCH 401 Materials and Methods (3 credits)

Introduces students to the technologies of light construction including wood framing, masonry, and concrete. Properties of these materials are analyzed and the problem associated with their assemblies are studied and graphically illustrated.

PREREQUISITES: ARCH 100; ARCH 150 or ARCH 160; ARCH 151 or ARCH 161.

ARCH 501 Structures I (Statics) (3 credits)

Study of force composition, effect, resolution, equilibrium and the strength, mechanical and elastic properties of materials. PREREQUISITES: MATH 007.

ARCH 502 Structures II (Strength) (3 credits)

Elementary analysis and design of structural framing members in wood, steel and concrete.

PREREQUISITES: ARCH 501.

ARCH 521 Introduction to Environmental Systems I (3 credits)

Exploration of energy issues and conservation, climate, and heat loss and gain as factors in environmental design. PREREQUISITES: MATH 007; PHYS 008; ARCH 200; ARCH 402.

ARCH 522 Introduction to Environmental Systems II (3 credits)

Examination of principles and technologies of life safety systems, vertical transportation systems, electrical supply and distribution systems, lighting, and acoustics and their integration with architectural design. PREREQUISITES: ARCH 201; ARCH 501; ARCH 521.

ARCH 530 Introduction to Sustainability (3 credits)

This introductory course will examine the meaning, history, sources, context and strategic approaches towards sustainability as viewed through a design lens. To approach an understanding of sustainable design, however, one must first explore what it means to be sustainable and why it is of primary importance in today's world, especially in architecture and design. This course will take a macro approach toward sustainability by casting a broad net on what the operating principles and strategies of sustainable design should espouse. This course is not intended to create a detailed analysis of specific projects or energy models for high performance buildings. It is meant to introduce students to a number of sustainable strategies and to inculcate the necessity for their inclusion in all design.

PREREQUISITES: None.

ARCH 570 Public Issues, Climate Change and Architecture (3 credits)

Introduces students to key issues and factors linking architects to the public through an examination of historical developments, public policy and contemporary development initiatives. An emphasis is placed on issues related to the proliferation of suburbia and the resurgence of urban centers in North America. Human settlements and buildings are shaped within processes and systems regulated by government. They are also a reflection of cultural and social values, channeled through the work of design and development professionals.

PREREQUISITES: ARCH 203.

ARCH 651 Principles of Urban Design (3 credits)

Exposes architecture students to the concepts, methodologies, techniques and attitudes of urban design to convey an understanding of urban design in the contexts of both the micro and macro scales of the built environment and to sensitize students to the place of architectural interventions in systems of urban design.

PREREQUISITES: ARCH 201; ARCH 302; ARCH 521.

ARCH 720 Advanced Architecture Theory (3 credits)

The course will examine how architectural theory has continued to expand at such a rate that it is impossible to address the entirety of the current discourse in one or even several courses. The objective here is to provide a grounding in the main streams of theoretical thinking, to acquaint the student with principal voices in architectural discourse and the defining differences in current thinking as well as provide a useful way of organizing the varying ideas in that discourse into some coherent and useful system of thought. PREREQUISITES: ARCH 205

ARCH 751 Professional Practice (3 credits)

Study of standard practices of the architectural profession, including ethics, contracts, performance criteria and fiscal management. PREREQUISITES: ARCH 202; ARCH 951.

ARCH 891 Thesis Preparation (3 credits)

Research methods, analysis, and program development for thesis project. PREREQUISITES: ARCH 204; and within 36 credits of completion of the curriculum.

ARCH 951 Construction Documents I (3 credits)

Involves the preparation of technical, professional and legal documentation for building projects. PREREQUISITES: ARCH 200; ARCH 202; ARCH 266, ARCH 401; ARCH 502; ARCH 522.

ARCHITECTURE PROFESSIONAL ELECTIVES**ARCH 219 Contemporary Issues in Architecture (3 credits)**

This course is part of the History/Theory set of professional electives. Through a series of readings, debates and open discourse, the course will examine the evolution of contemporary architectural thought and teach students how to take a critical position on professional practice and issues that affect design today including sustainability, phenomenology, ethical responsibility and roles of the architect in the world in the 21st Century. Specifically, the course will focus on four sequential areas of study: 1) Historical Perspectives to address how we arrived to today and to understand your worldview; 2) The Tenets of Good Design from the aesthetics of color exploration to sustainability; 3) Phenomenology to examine Sensory and Emotional Explorations; and 4) Comparative Dialogues to explore where Architecture is going in the Post-Covid-19 era. PREREQUISITES: ARCH 301, ARCH 302

ARCH 232 Women in Architecture and Design (3 credits)

Lecture course that focuses on the contribution of women to architecture and design. Focuses on African American architects in the United States and also introduces a broader context of practitioners around the world. PREREQUISITES: Successful completion of first year.

ARCH 233 The Black Architect: A Historical Perspective (3 credits)

Seminar/independent research course that focuses on the history of Black architects and architecture in the United States to introduce students to an overview of the history, practice and influence of Black architects from the antebellum years through reconstruction, modern and present contemporary periods. PREREQUISITES: None.

ARCH 271 Digital Tools in Architecture II (3 credits)

Introduces architecture students to computer applications to architecture. Provides computer literacy for both business and graphic computer applications and systems management. PREREQUISITES: ARCH 270.

ARCH 272 Digital Tools in Architecture III (3 credits)

Introduces architecture students to computer applications to architecture. Provides computer literacy for both business and graphic computer applications and systems management. Focuses on Autodesk Revit software. PREREQUISITES: ARCH 270.

ARCH 380 Special Topics in Architecture and Urbanism (3 credits)

Introduces a wide range of perspectives on architecture, urban and community design and planning issues. For current offerings will be available from the Department of Architecture. This course may be taken four times for credit as long as different topics are selected. PREREQUISITES: None. Open to non-majors.

ARCH 421 Housing Design and Equity (3 credits)

Focuses on providing a working understanding about roles, responsibilities, and opportunities available to the young architect in urban settings in the creation of affordable housing amidst the rapidly increasing gentrification of urban neighborhoods and communities. Students will study the impact of market forces, land cost, zoning, building codes, construction, development finance, public-private partnerships, and architecture/urban design in community development.

PREREQUISITES: Third year standing.

ARCH 430 Health and Design (3 credits)

This course will provide students with a framework to assess different urban and built environments from health and wellbeing viewpoints. Students in this class will learn about tools and techniques of designing healthier buildings and communities through a series of case studies, contemporary developments and best practices. Based on the readings, lectures, blackboard discussions, and assignments, students will become more capable of identifying opportunities to increase community health and well-being, and thereby improve the quality of life of urban populations within their work as architects, planners, health care practitioners and within other professional endeavors. PREREQUISITES: None.

ARCH 440 Ecology and Architecture (3 credits)

The course is an exploration of the influence of Ecology and Architecture. It includes Ecology, Biophilic design and Biomimicry. It also includes an implementation of biophilic design as evidence-based design method to improve health and wellbeing of the occupant. The influence of Biomimicry is explored as innovation method to achieve better performance in buildings. The course also explores both macro-level urban ecology and microlevel building and its interaction with nature and people. PREREQUISITES: None.

ARCH 803 Independent Study (3 credits)

Independent study in the area of the student's professional interest. Students must complete an Independent Study Proposal and have it signed by their major advisors as well as the Department Chair.

PREREQUISITES: Fourth or fifth year standing and approval of the faculty and Department Chair.

ARCH 811 Directed Studies (3 credits)

Students work closely with an instructor or the department chair on a designated project within the Department of Architecture, faculty research or other initiative. Required guided independent study at the advanced level. PREREQUISITES: Department Chair approval.

OPEN ELECTIVE COURSES

Classes in this category may be either architecture (Architecture Professional Electives) or non-architecture (General/Liberal Studies Electives) courses.

See [Course Descriptions of non-architecture classes](#)

See [Howard University Student Registration Webpage for non-architecture classes](#)