Roy G. Perry College of Engineering

Purpose and Goals

The modern mission of the Roy G. Perry College of Engineering, in the new millennium, is to sustain an infrastructure that will attract and maintain a world-class faculty that produces graduates with the highest level of professional standards. These graduates will be prepared for a career of life-long learning that will result in leaders, productive workers, innovators and entrepreneurs who will positively impact the increasingly multi-disciplinary and diverse national economy. The College serves as a value added partner within the University to meet the challenge to excel in education and research in engineering and computer science; and to service regional, national, and global communities.

This mission is accomplished through the following six goals:

1. Strive for excellence in engineering education through the dissemination and interpretation of knowledge through the educational programs.
2. Recruit and retain students who have demonstrated a capacity to excel in an environment that integrates advanced information technology with creativity, critical thinking, and problem solving.
3. Recruit and retain a cadre of world-class faculty effective in every endeavor of student-faculty interaction and committed to maintaining an academic standard that will ensure the students are highly competitive for graduate or professional school or for employment in the private or public sectors.
4. Promote scholarly activities through the continual development of our research centers and other collaborations and further enhancing our incorporation of undergraduate and graduate research activities.
5. Continue strong external relations that cultivate and integrate our corporate and alumni constituents into partnerships with the College.
6. Maintain the appropriate infrastructure and support services necessary to provide an atmosphere conducive to learning.

Instructional Organization

The Roy G. Perry College of Engineering offers the following degree programs:

Program	Degree Offered
Chemical Engineering	BS
Civil Engineering	BS
Computer Engineering	BS
Computer Information Systems	MS
Computer Science	BS, MS
Electrical Engineering	BS, MS, PhD
Engineering	MS
Mechanical Engineering	BS

College Admission and Academic Requirements

High School Preparation for Admission to the Roy G. Perry College of Engineering

For students intending to pursue a major in engineering, the recommended curriculum is defined by the "Recommended Texas High School Program Graduation Requirements" and approved by the State Board of Education in November 1993. The listing below reflects the current State Board recommendation and expands upon the University requirements stated earlier in this catalog:

Suggested High School Course Work

In support of the aforementioned requirements, an additional year of advanced mathematics (e.g., Calculus) is recommended. Chemistry and Physics are foundations for all engineering programs and are strongly recommended. Further, students planning careers in the health or biomedical engineering professions should take one year of biology. Additionally, students are urged to take advantage of advanced placement opportunities and honors programs.

Moreover, a student who enrolls without having completed the above courses will not be optimally prepared and the duration of the student's undergraduate program will likely be extended. In particular, the engineering programs offered by the college are based upon a student being fully prepared to begin study with Calculus and Chemistry for Engineers at the college level. Prerequisites for Calculus and Chemistry for Engineers are considered deficiencies and are not counted toward an engineering degree.

Admission to the Roy G. Perry College of Engineering

Admission to the Roy G. Perry College of Engineering is based on the University's undergraduate admission requirements plus the following additional admission criteria for the Roy G. Perry College of Engineering. A student is admitted directly into a major only if all admission criteria are met.

First-time Freshmen – Engineering and Computer Science Majors

First-time freshmen will be evaluated on the basis of the following admission criteria that are applicable for the student:

1. Students must meet the Prairie View A&M University admissions requirements.
2. Students must present a new SAT Reasoning Test score of 950 (based on combined verbal and math scores only) or higher or a composite ACT score of 18 or higher.
3. Must have a cumulative high school GPA of 3.0 on a 4.0 scale

Students Entering with Transfer Credit

Transfer students include those from other units within Prairie View A&M University as well as those from other educational institutions. Transfer students external to Prairie View A&M University must furnish an official transcript to the Office of Admissions for evaluation of all college-level work completed. Transfer students with less than 30 hours of transferable credit are admitted under the criteria for first-time freshmen.

Transfer students with 30 hours or more of transferable credit must meet the following requirements:

1. Students must meet the Prairie View A&M University and the Roy G. Perry College of Engineering admissions requirements.
2. Must have a “C” or higher in all transfer courses.
3. Must have a minimum cumulative GPA of 2.5 on a 4.0 scale in all math, science, and engineering courses.

College Academic Requirements

Along with meeting the general requirements of the University, students enrolled in the Roy G. Perry College of Engineering must maintain the following performance levels in order to satisfy degree requirements:

1. Earn an overall grade point average of 2.0 or better in courses taken outside of the college and earn a grade of “C” or better in English, Mathematics, and Science courses.
2. Earn a grade of “C” or better in each course taken within the College.
3. Earn a grade of “C” or better in the prerequisite before advancing to the next level course in a sequence for English, Mathematics, and Science courses.
4. Earn a grade of “C” or better in prerequisite courses before advancing to the next level course in College courses.
5. Demonstrate professional standards and ethical conduct.
6. Three-Attempt Rule: A student may not attempt a course in Mathematics, Science, or Engineering in the Roy G. Perry College of Engineering at PVAMU more than three times and apply that course toward his/her degree. Enrollment in a course for a period of time sufficient for assignment of a grade, including a grade of “W”, is considered an attempt. After a student failed a course attempt twice by not receiving a grade of “C” or higher, he/she must obtain approval from the Department Head to enroll in the course for the 3rd time.

Students who transfer from other colleges and universities should meet the University’s scholastic regulations and additional core curriculum requirements for engineering.

University Core Curriculum For Engineering Programs

The core curriculum concept provides for the portability of a basic element of a college degree between higher education institutions. However, certain programs have specific requirements in their programs that must be satisfied for the purpose of accreditation. For a specific program, the core curriculum may look different to most efficiently satisfy both the core and program-specific requirements. For ABET-accredited engineering programs, for example, the math requirement in the core curriculum is best satisfied if the engineering student takes Differential Equations. The program-specific core curriculum requirements presented for degree programs in the Roy G. Perry College of Engineering represent the suggested University Core Curriculum designed for an engineering student to minimize the coursework required.

Students who undertake a more general core curriculum may require additional coursework. For example, the Roy G. Perry College of Engineering requires a programming language course so that some 3-hour courses that satisfy the University Core Curriculum may not be acceptable for the Roy G. Perry College of Engineering degree programs.

Eligibility to Take Upper Division College Courses

The Roy G. Perry College of Engineering has an eligibility standard for the students to take upper-division college courses. Students must have completed or be currently enrolled in all lower division (1000 and 2000 level) courses in English, Mathematics, Science, and Engineering to be eligible to enroll in upper-division (3000 or 4000 levels) courses in the Roy G. Perry College of Engineering. Students transferring to the Roy G. Perry College of Engineering with 60 or more semester hours from another institution will be allowed a period of one semester to comply.

Purpose and Goals

The graduate Engineering programs are designed to enhance the student’s research capabilities and to make the student more competitive in the professional practice. They are the continuation of the intellectual, scholarly and professional development of the individual producing technological

leaders and creative engineers and computer scientists devoted to the discovery, development, and refinement of knowledge and methodologies associated with the various engineering and computer disciplines. Each degree candidate is expected to have demonstrated the highest degree of professional ethics and standards. The College of Engineering provides excellent facilities in support of its graduate programs.

Admission to Programs

Master's Programs

The following are university admission requirements to the master's programs in the College of Engineering. Students will be awarded graduate degree status admission if they satisfy all the admission requirements.

1. Meet the requirements for admission to Graduate Studies.
2. Have an undergraduate degree from an ABET (or equivalent) accredited program.
3. Have a cumulative Grade Point Average (GPA) of 2.75 on a 4.00 scale.
4. Have a previous educational background in the intended area of study.

Students may be awarded non-degree admission status if they satisfy the requirements as outlined in the catalog section "Types of Admission" under Admissions Information and Requirements.

Doctoral Program

The following are admission requirements to the Doctor of Philosophy program in the Department of Electrical Engineering. The candidate should:

1. Hold a baccalaureate degree in engineering, mathematics, or the physical sciences conferred by a regionally accredited institution.
2. Have a 2.75 Grade Point Average (GPA) on a four-point scale on all completed undergraduate course work.
3. Hold a Masters of Science degree in Electrical Engineering or one of the related disciplines, conferred by an accredited institution.
4. Have a 3.2 GPA on all completed graduate work.
5. Produce original transcripts for all academic work completed at the undergraduate and graduate levels.
6. Submit three letters of recommendation. These should preferably come from faculty sufficiently acquainted with the student to comment on the student's potential to successfully complete the doctoral program.
7. Submit a personal statement describing the applicant's academic or professional accomplishments, research interest, and professional goals.
8. International students may be required to take the Test of English as a Foreign Language (TOEFL); a score of 550, or higher, is required.

Master of Science in Engineering Degree Program

The Master of Science Degree in Engineering is a general engineering program with four areas of concentration:

- Chemical Engineering
- Civil Engineering
- Environmental Engineering
- Mechanical Engineering

Each area of concentration has an option of a thesis or non-thesis degree plan. Each option includes 12 semester credit hours of graduate courses in general engineering with the remaining hours to be determined by the student and his academic advisor during the first semester of acceptance to the graduate program as a degree status student.

During the first semester of graduate degree status, the student should select an advisory committee consisting of at least three members, two of whom must come from the engineering faculty, and the chairman of the committee who shall be a full member of the graduate faculty in engineering.

Degree Program Requirements

General Engineering Requirements [1]		
Select four of the following:		12
GNEG 5306	Engineering Analysis I	
GNEG 5307	Engineering Analysis II	
GNEG 5304	Engineering Probability and Statistics	
GNEG 5313	Engineering Numerical Methods	
GNEG 5319	Special Topics [3]	
Option (Select one below)		**18**
Thesis Option		
GNEG 5608	Thesis	

Technical Electives (12 hours of graduate level courses identified based on concentration and in consultation with advisor)		
Non-Thesis Option		
GNEG 5320	Graduate Internship [4]	
or GNEG 5330	Graduate Project	
Technical Electives (15 hours of graduate level courses identified based on concentration and in consultation with advisor)		
Total Hours		**30**

1 The student must consult his/her academic advisor and take at least two courses in GNEG 5306, GNEG 5307, GNEG 5304, and GNEG 5313 .

2 Prior approval by the Degree Program Head is required for taking the Graduate Internship.

3 GNEG 5319 may be repeated when topic changes.

4 Select either GNEG 5320 for an internship or GNEG 5330 for a project.

MSENGR Engineering

First Year

Fall - Semester 1	Hours	Spring - Semester 2	Hours
General Engineering Requirement	3	General Engineering Requirement	3
General Engineering Requirement	3	General Engineering Requirement	3
Technical Elective	3	Technical Elective	3
Total	**9**	**Total**	**9**

Total Hours: 18

Second Year

Fall - Semester 1	Hours	Spring - Semester 2	Hours
Technical Elective	3	Option	6
Technical Elective	3	Thesis Option	
		GNEG 5608	
		Non-Thesis Option	
		GNEG 5320	
		or GNEG 5330	
Total	**6**	**Total**	**6**

Total Hours: 12

Total Semester Credit Hours: 30

Marketable Skills

Marketable skills, as defined by the Texas Higher Education Coordinating Board's 60x30TX Plan (http://www.60x30tx.com/), include interpersonal, cognitive, and applied skill areas, are valued by employers, and can be either primary or complementary to a major. Marketable skills are acquired by students through education, including curricular, co-curricular, and extracurricular activities.

MSENGR Engineering

Degree Skills

1. Ability to use a logical and creative approach to solve complex engineering problems
2. Ability to plan, design, and organize complex projects
3. Advanced oral and written communication skills related to technical subject matter

Concentration Skills

1. Hypothesis-driven research formulation and execution
2. Ability to use or develop data science analytics tools
3. Advanced mathematical and analytical skills that are applicable to one or more of Chemical Engineering, Civil Engineering, Mechanical Engineering, or Electrical and Computer Engineering, and Computer Science

Co-curricular and Extracurricular Skills

1. Interpersonal skills that promote collaboration and emphasize behavior and conflict resolution
2. Industrial and practical experience through internships and sponsored projects
3. Experience with preparing and delivering results at technical and scientific conferences

Supporting Facilities

Research Centers

The Center of Excellence in Research and Education for Big Military Data Intelligence (CREDIT) (http://credit.pvamu.edu/)

The CREDIT center is a research center targeting mission-critical big data analytics and platforms with a five-million-dollar seed funding from the US Department of Defense (DOD). The center's research focus includes deep learning, big data analytics, wireless sensor networks, data security, and the Internet-of-Things (IoT). CREDIT center has a multidisciplinary team of faculty researchers from Electrical and Computer Engineering and Computer Science, research scientists and postdocs, and many graduate and undergraduate research assistants. This center is supported by 3 labs: the Deep Learning Lab, the Cloud Computing Lab, and the Wireless Communications Lab. The Deep Learning Lab in this center features four NVIDIA DGX-1 Deep Learning systems totaling 32 Tesla P100 GPUs with 114,688 CUDA cores, 2,752 GB memory, and 244 TB HDD. Each DGX-1 system has eight Tesla P100 GPU accelerators connected through NVLink, the NVIDIA high-performance GPU interconnect, in a hybrid cube-mesh network. Together with dual socket Intel Xeon CPUs and four 100 Gb InfiniBand network interface cards, DGX-1 provides unprecedented performance for deep learning. Moreover, the DGX-1 system software and powerful libraries are tuned for scaling deep learning on its network of Tesla P100 GPUs to provide a flexible and scalable platform for deep learning.

The Center of Excellence for Cybersecurity (SECURE) (https://securecenter.pvamu.edu/)

The SECURE Center is focused on developing novel protocols to ensure cybersecurity in multiple environments—communications and networks, power grid, social networking in virtual space, cloud computing, and video analytics. It is also engaged in developing sensitive techniques for malware and virus detection and elimination. The center develops innovative technologies such as hardware/software co-design, novel low-cost security primitives, and AI solutions for malicious behavior detection. Another area of emphasis is information (video, image, text and audio) steganography using discrete wavelet transform and artificial intelligence. This center is supported by 5 labs: Network Security lab, IoT Security Lab, Hardware Security Lab, IP Networking Lab, and Wireless Security Lab.

The Smart MicroGrid Advanced Research and Technology Center (SMART) (https://www.pvamu.edu/smartgrid/)

The vision of the SMART Center is to create multitude of smart microgrids in the world that are reliable, sustainable, secure and more environmentally safe. The center is focusing on the following areas: (i) enhancing the power quality for the microgrid, (ii) optimizing the electromagnetic compatibility (EMC) of electronic devices in the microgrid, (iii) providing secure and robust data collection and exchange in the microgrid, (iv) designing novel fault detection, protection, and control of the microgrid, and (v) designing a test bed for experimental validation. The center is currently working on the following projects: 1) Modeling and Simulation of Low-Cost and High-Efficiency Solar Cells for the Microgrid, 2) Novel Model Predictive Control for Electrical Machine Drives Considering Circuit Faults, 3) Microgrid Distribution Power Flow Controller (DPFC) Based on Fuzzy and ANFIS Techniques, 4) Maximum Power Point Tracker (MPPT) Improvement for Energy Harvesting Systems, 5) Effects of Electromagnetic Interference on the Smart Grid, and 6) Electric Load Forecasting using Smart Meter Data.

The Center for Computational Systems Biology (CCSB@PVAMU) (https://ccsb.pvamu.edu/)

The CCSB center is a multidisciplinary center which studies complex biological processes such as cancer, head injury in football, Parkinson's disease, pulmonary hypertension, and herbicide-resistant weeds, by employing state-of-the-art computational and engineering skills. External collaborations include Translational Genomics Research Institute, Salk Institute, University of Pittsburg Medical Center, and the University of Cambridge. The Center is supported by funds from the CRI, NCI/NIH, Stand up To Cancer (SU2C), NSF, and Michael J. Fox Foundation (MJFF).

Center for High Pressure Combustion in Mircrogravity (https://www.pvamu.edu/research/post/college-of-engineering-awarded-3-million-grant/)

This NASA center consist of a multidisciplinary team of researchers from the College of Engineering, the College of Agriculture & Human Science and the College of Arts & Science focus on the science and engineering of fuel combustion under high pressure in microgravity representative of practical engines. The project, emphasizes both experimental and numerical approaches, is part of NASA's efforts to guide advanced engine designs to improve overall engine performance to keep the nation's leadership in engineering and science areas.

The Center for Energy and Environmental Sustainability (CEES) (https://www.pvamu.edu/cees/)

The CEES center was established with seed funding in the amount of $5M in 2010. The Center for Energy & Environmental Sustainability (CEES) conducts research in the areas of renewable energy and environmental sustainability. An area of focus for this center is biofuels research which include in-depth fundamental studies to understand the reaction pathways of fast pyrolysis and how they affect the final composition of bio-oil and other by-products as process variables are varied in an effort to improve yields and quality of specific chemical species present in the bio-oil.; design of biofuels reactors for process and yield investigation of catalytic pyrolysis of biomass into biofuels and the development of catalytic conversion strategies for upgrading bio-oil to useful fuels. Additional research involves TGA reaction kinetics study of the pyrolysis process for different biomass.

The Center of Excellence for Communication Systems Technology Research (CECSTR) (https://www.pvamu.edu/cecstr/)

This center received seed funding from Texas Instruments to conduct comprehensive research in the selected aspects of communication systems, Wavelets and Wavelet Transforms, Compressed Sensing/Compressive Sampling Systems, DSP Solutions, Signal/Image/Video Processing, Mixed Signal Systems, Communication Control Systems and High Speed (Broadband) Communication Systems. Among other emerging areas of research, it also seeks solutions to the problems that plague both military and commercial satellite and radar-based communication systems.

The Thermal Science Research Center (TSRC) (http://www.pvamu.edu/tsrc/)

The TSRC is focused on the design and development of physical models to couple heat transfer measurements and modeling, single-phase and two-phase flow measurements and correlation development, interdisciplinary design and development of enclosed natural convection modeling and measurements, and mixed convection modeling. Research results are of importance to fusion reactions, cooling of electronic components, and other high heat flux applications, such as magnetic fusion plasma-facing components, rocket and propulsion systems.

The Future Aerospace, Science and Technology (FAST) (https://www.pvamu.edu/me/wp-content/uploads/sites/100/fast.pdf))

The FAST Center is dedicated to the development, processing, and characterization of lightweight and high-temperature structural materials and nanomaterials with emphasis on research, education, and technology transfer. Research activities include the processing, characterization, and environmental simulation of nanocomposites for use in both military and civilian applications.

The Texas Gulf Coast Environmental Data (TEXGED) (https://www.pvamu.edu/engineering/research/texged/):

This Center collects data from space through NASA for predicting environmental changes in the region and for developing a methodology for ecosystem risk assessment. The Center also uses remote sensing data in detecting the sea surface temperature in the Gulf of Mexico to study its impact on biological activities. The TEXGED Center aims at collecting and analyzing data regarding environmental problems such as alteration and loss of habitats, water pollution, air pollution, flooding and hurricanes, climatic changes and degradation and loss of green spaces.

The Center for Radiation Engineering and Science for Space Exploration (CRESSE) (https://www.pvamu.edu/cresse/))

The CRESSE center is focused on developing materials and technologies that would keep astronauts and their critical electronic equipment safe from the effects of harmful space radiation. The Center carries out research in the area of developing space radiation detection systems in testbed zones during exposures at particle accelerator facilities and obtaining detailed dosimetry data and particle spectroscopy data for use in prediction of risks of space radiation in environment and health.

PAST PERFORMANCE

Several of the research centers have become nationally recognized. All of the center researchers have published papers in peer reviewed journals and conferences at both the national and international levels. The centers have secured funding from industry and various government agencies including NSF, NIH, DOD, DOE, NASA, Apple, .Google, IBM, and Chevron

Combined BS/MS Programs in College of Engineering

The Roy G. Perry College of Engineering follows the University's guideline of combined BS/MS programs to encourage qualified undergraduates to start graduate study before completing their BS degrees. By entering in a combined BS/MS status, a student is eligible to count up to 6 semester credit hours toward both the BS degree and the MS degree.

Admission to combined BS/MS programs

An undergraduate student who intends to enter a graduate program in the College of Engineering through the combined BS/MS program must apply through the College of Engineering Dean's Office. An application form (https://www.pvamu.edu/engineering/departments/five-year-bsms-programs/) can be obtained in the Dean’s Office or on the homepage of the College of Engineering website (https://www.pvamu.edu/engineering/).

Approval of the combined BS/MS programs will primarily be decided by the Program Head/Department Head of the intended graduate program. The following is a guide of allowable combinations between the BS and MS programs:

Allowable Combinations of BS/MS programs in College of Engineering

- Computer Science/Computer Science
- Computer Science/Computer Information Systems
- Computer Engineering/Electrical Engineering
- Electrical Engineering/Electrical Engineering
- Chemical Engineering/Engineering
- Civil Engineering/Engineering
- Mechanical Engineering/Engineering

Special Programs

Engineering Internship/Cooperative Education. The primary goal of an internship or cooperative education experience is to strengthen and enhance the theoretical knowledge gained through classroom or distance education-based experiences. The objectives of internships and cooperative education are to:

1. Provide students with opportunities to obtain professional industrial/government internships.
2. Prepare graduates for immediate professional assignments without further on-the-job training.
3. Provide a closer partnership between employers and the Roy G. Perry College of Engineering.
4. Help students determine which type of organizational structure and corporate culture best suits them.

Students in the program are required to enroll in internship or cooperative education courses while they are employed in industry/government. They continue to be governed by College and University regulations concerning professional conduct during the employment period. Students are normally paid wages/salaries by the employing agency.

The Roy G. Perry College of Engineering Enhancement Institute (CE2I) is an innovative and intensive summer bridge-to-college program designed to prepare students for the rigors of an Engineering, Computer Science, or Technology Curriculum and to aid with the transition between high school and college. The Institute is a five-week residential program, where participants will complete coursework in Math, Science, Technology, and Professional Development Activities. The Institute is math-intensive. A math assessment test will be administered initially to determine the appropriate math placement. The program goal is to achieve a mastery of one math level higher than the student placed when he/she entered the program. The program will also introduce students to basic concepts in chemistry, physics, and computing. Students will experience professional development activities including field trips to area engineering and technology industries; personal and professional development seminars and workshops (i.e. time management, study skills, learning style inventories, effective use of study groups, and seven habits of successful people).

Energy Engineering as a Minor Field

The Energy Engineering Minor curriculum is designed to prepare students to enter directly into a wide variety of careers in the energy sector serving the greater Houston area, state, national and international communities. Students of all majors are encouraged to enroll in the courses offered through the program. The curriculum is designed to work within the structure of the students' majors.

The Center for Energy and Environmental Sustainability (CEES) is instrumental in developing the Energy Engineering Minor. The goal of this center is to establish research and education focused on energy engineering. The three research themes of the center are biofuels, wind energy and energy, and the environment. More information on the center is available at www.pvamu.edu/cees (http://www.pvamu.edu/cees/).

The Energy Engineering Minor has four focus areas:

- Chemical Engineering - Fossil Fuel and Nuclear Energy Focus
- Civil and Environmental Engineering - Energy and Environment Focus
- Electrical Engineering - Generation and Distribution Focus
- Mechanical Engineering – Renewable Energy Focus

Students shall complete the Energy Engineering Minor through satisfactory completion of 18 SCH from the following courses:

Energy Engineering Minor Requirements		
CHEG 3311	Introduction to Energy Systems	3
CVEG 4305	Special Topics [1]	3
MCEG 3312	Renewable Energy and Energy Sustainability	3
Electives (select 9 hours from the following options):		**9**
CHEG 4310	Special Topics in Chemical Engineering [1]	3
ELEG 4301	Electromechanical Energy Conversion	3
ELEG 4302	Power Systems Engineering	3
ELEG 4322	Electronic and Photonic Materials and Devices	3
MCEG 4316	Special Topics [1]	3
Other energy related courses approved by the College		
Total Hours		**33**

[1] This special topics course may be repeated when the topic varies and is related to broader energy engineering or environmental sustainability or as approved by the advisor.

College Professional and Honor Societies

Among the honor societies designed to support, augment, and supplement the educational and professional development of students are the departmental honor societies and ***Tau Beta Pi, National Engineering Honor Society***, through the Texas Kappa Chapter. In addition, the Roy G. Perry College of Engineering sponsors the following chapters of national societies:

The Society of Women Engineers, Prairie View A&M University Student Chapter is a professional society open for membership to female students majoring in an engineering curriculum at the University. The Chapter is affiliated with the national professional engineering body, the Society of Women Engineers. The society fosters the intellectual, professional, personal and social development of student members.

The Society of Hispanic Professional Engineers **(SHPE)** is a professional society open to all engineering students in the Roy G. Perry College of Engineering. The student chapter at Prairie View is affiliated with the National Society of Hispanic Engineers professional society. The society endeavors to change lives by empowering the Hispanic community to realize their fullest potential and impact through STEM awareness, access, support and development.

The Prairie View A&M University chapter of the ***National Society of Black Engineers (NSBE)*** is a professional society open to all engineering students in the Roy G. Perry College of Engineering. The chapter fosters intellectual and professional development among its members and promotes growth and entry of more minority persons into the engineering profession.

The Prairie View A&M University (PVAMU) **Engineers Without Borders (EWB)-USA** Student Chapter was established in September 2020. The PVAMU EWB-USA Student Chapter's mission is to build a better world through sustainable development projects that empower communities to meet their basic human needs. Volunteer professionals from outside the PVAMU campus have been recruited to serve as prospective project mentors, thus ensuring that the Chapter's technical knowledge and resources are available to solve the world's most pressing challenges faced by vulnerable domestic and international communities. PVAMU EWB-USA Student Chapter is open to undergraduate and graduate students representing a variety of backgrounds, interest, and skill sets from the various academic majors offered at PVAMU. These majors include engineering, medicine and public health, sociology, language, business, and other areas.

The Chemical Engineering, Civil Engineering, Computer Science, Computer Engineering, Electrical Engineering, and Mechanical Engineering programs are accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

The Computer Science program is accredited by the Computing Accreditation Commission of ABET, http://www.abet.org.

For more information about specific programs see the links below.

- Chemical Engineering Accreditation (https://www.pvamu.edu/cheg/accreditation/)
- Civil Engineering Accreditation (https://www.pvamu.edu/cee/accreditation/)
- Computer Science Accreditation (https://www.pvamu.edu/engineering/departments/cs/undergraduate/accreditation/)
- Computer Engineering Accreditation (https://www.pvamu.edu/ece/accreditation/)
- Electrical Engineering Accreditation (https://www.pvamu.edu/ece/accreditation/)
- Mechanical Engineering Accreditation (https://www.pvamu.edu/me/accreditation/)

Chemical Engineering Courses

CHEG 1101 Intro Engr, Comp Sci & Tech: 1 semester hour.
Introduction to basic engineering, computer science and technology concepts. Students will become aware of the various disciplines of engineering, computer science and technology, ethical and professional responsibilities in these fields, creativity and design.
Co-requisites: CHEG 1102, GNEG 1010.

CHEG 1102 Intro CHEG Lab: 1 semester hour.
Introduction to the field of engineering, industries, careers, and the curriculum. Basic engineering terms, concepts, calculations problem solving skills, ethics, and computer applications.
Co-requisite: CHEG 1101.

CHEG 1202 Introduction to Computations in CHEG: 2 semester hours.
An introductory course of important chemical engineering concepts and computations. Students will learn how to classify problems based on their mathematical nature. Topics include basic introductory calculations involving material and energy balances, fluid flow phenomena, fundamental thermodynamics and kinetics, and introductory software and simulation tools such as Visual Basic and CHEMCAD.
Prerequisites: CHEG 1102 or CHEG 1021.
Co-requisite: MATH 2413.

CHEG 2215 Biochemical Engineering Fundamentals Lab: 2 semester hours.
This course consists of biochemical engineering laboratory experiments, with emphasis on biochemical reactors, mass transfer in bioreactors, microbial transformations and enzyme catalyzed reactions and their control. Measurement of maximum specific growth rate, saturation constants of substrates, kinetic constants of enzymes and characterization of immobilized enzymes will be carried out. Analysis oxygen absorption rates in shake-flasks in the study of control of respiration and fermentation in baker's yeast, kinetics of yeast growth, kinetics of free and immobilized enzyme reactions and operational decay constant and half-life of immobilized enzymes.

CHEG 2301 Materials Science: 3 semester hours.
Chemical bonding, atomic order and disorder, transport properties, single phase and multiphase materials, heat treatment, corrosion, and composites.
Prerequisites: (CHEM 1304 or CHEM 1043) or (CHEM 1403 or CHEM 1034).

CHEG 2308 Eco Anal Technical Application: 3 semester hours.
Fundamental concepts of economic principles. Evaluation of technical alternatives, economic significance of technical proposals; interest, description, analysis, and forecasting.
Prerequisites: MATH 2413 or MATH 1124.

CHEG 2315 Introduction to Biochemical Engineering Fundamentals: 3 semester hours.
This course introduce biology fundamentals and associated subjects required for engineers to understand and design multidisciplinary technology in the complementary areas of biological sciences and engineering. to accommodate those who do not have the biological background, the course covers basic biological principles and physiology. Subsequently, special emphasis is placed on applying engineering concepts to biological problems.
Prerequisites: CHEM 1304 or CHEM 1403.

CHEG 2316 Ethical Engineering in a Global Society: 3 semester hours.
An introductory view into how moral principles and standards are applied to the field of engineering. Students will learn how to navigate ethical problems. Topics include the responsibilities of an engineer, the code of conduct, ethical theories, ethics in the law, and case studies of engineering successes and failures.
Prerequisites: (CHEG 1101 or CHEG 1011) or (CVEG 1101 or CVEG 1011) or (ELEG 1101 or ELEG 1011) or (MCEG 1101 or MCEG 1011).

CHEG 2333 Material and Energy Balances: 3 semester hours.
Application of laws of conservation of mass and energy to reacting and non-reacting, simple and complex chemical systems. Application of both element and species balances to multiple reaction systems. Application of the degrees-of-freedom analysis to single process units and multi-unit process flow-sheets. Numerical solution techniques for the solution of balance equations.
Prerequisites: (CHEM 1403 or CHEM 1034) and (PHYS 2325 or PHYS 2513).

CHEG 2334 Chemical Engineering Thermodynamics I: 3 semester hours.
Introduction to chemical engineering calculations. PVT properties of fluids, equations of state. First and second laws of thermodynamics. Applications to heat effects and flow processes.
Prerequisites: CHEG 2333 or CHEG 2053.

CHEG 2615 Chemical Engineering Internship I: 6 semester hours.
This course is an internship program of work experience with an approved engineering firm.

CHEG 3101 Chemical Engineering Laboratory I: 1 semester hour.
Quantitative experimental study of properties of fluids, fluid mechanics, metering, and heat transfer. Operation and evaluation of equipment, techniques of graphical and statistical data analysis. Study of elements and methods of scientific inquiry and investigation, experimental data analysis, modeling and simulation, and dissemination of scientific results, including: design of experiments, product and process design, model validation and verification, literature survey and review techniques, and effective technical reporting modes. Strong emphasis is placed on safety.
Prerequisites: PHYS 2125 or PHYS 2511 and (PHYS 2126 or PHYS 2521) and (CHEM 1112 or CHEM 1021) and (COMM 1311 or COMM 1003) and (ENGL 1302 or ENGL 1133 or ENGL 1143 or ENGL 2311).
Co-requisites: CHEG 3301, CHEG 3304, MATH 3302.

CHEG 3301 Heat, Mass, and Momentum Transport: 3 semester hours.
Macroscopic and differential balances for heat, mass, and momentum. Energy balances and mechanical energy balances. Ideal Newtonian and non-Newtonian fluid behavior. Comparison of the transport processes in laminar and turbulent flow. Dimensional analysis.
Prerequisites: (CHEG 2334 or CHEG 2043) and (MATH 2320 or MATH 2043).

CHEG 3302 Unit Operations: 3 semester hours.
Application of transport theory to the design of equipment for the pumping and transfer of fluids through pipes, heat exchange, interphase transfer of heat and mass for the separation and purification of process streams.
Prerequisites: CHEG 2333 or (CHEG 2053 or CHEG 2305).

CHEG 3304 Chemical Engineering Thermodynamics II: 3 semester hours.
Properties of ideal and non-ideal binary and multi-component mixtures. Study of phase equilibria for single- and multi-component systems based on methods of corresponding states, equation of states and activity coefficient. Chemical equilibria applied to both homogeneous and heterogeneous systems.
Prerequisites: (CHEG 2043 or CHEG 2334).

CHEG 3305 Equilibrium Stage Separation Processes: 3 semester hours.
Applications of heat and mass balances and phase equilibria to the design of staged separation processes. Use of graphical methods such as McCabe Thiele and Ponchon Savarit for the treatment of binary systems. Application to distillation, absorption, stripping, and extraction.
Prerequisites: CHEG 2333 or CHEG 2053 and (CHEG 3304 or CHEG 3053).

CHEG 3306 Chemical Reaction Kinetics and Reactor Design: 3 semester hours.
Application of fundamental concepts of reaction stoichiometry, chemical and biochemical kinetics, and equilibria to the interpretation of reaction rate data. Application of reaction rate and heat and mass transfer correlations to the design of batch reactors, continuous staged reactors, and tubular reactors.
Prerequisites: MATH 2320 or MATH 2043 and (CHEG 3304 or CHEG 3053) and (CHEG 2301 or CHEG 2013).

CHEG 3311 Introduction to Energy Systems: 3 semester hours.
This course introduces fundamental physical and engineering principles associated with various energy systems. Basic energy concepts will be introduced describing the magnitudes and patterns of human energy needs. Historical evolution and present status of the conventional fossil and nuclear-fueled energy will be investigated along with others such as hydropower, biofuels, and the developing renewable energy systems.
Prerequisites: (MATH 2414 or MATH 2024) and (PHYS 2326 or PHYS 2523) and ((CHEM 1403 or CHEM 1034) or (CHEM 1304 or CHEM 1043)).

CHEG 3312 Petroleum Engineering Fundamentals: 3 semester hours.
This course consists of an overview of petroleum industry and petroleum engineering including nature of oil and gas reservoirs, petroleum exploration and drilling, formation evaluation, well completions and production, surface facilities, reservoir mechanics, and improved oil recovery.

CHEG 3315 Introduction to Biotechnology: 3 semester hours.
This course introduces students of chemical engineering, biological sciences, and chemistry to biological concepts and Nano scale considerations in engineering applications. It provides training for effective communication, hands-on skills, and analytical tools needed to pursue careers in biological/ biochemical, and biopharmaceutical process industries. Ties to relevant current research will be explored.
Prerequisites: CHEM 1304 or CHEM 1043 or CHEM 1403 or CHEM 1034 and (CHEM 2303 or CHEM 2033).

CHEG 3615 Chemical Engineering Internship II: 6 semester hours.
This course is an internship program of work experience with an approved engineering firm.

CHEG 4101 Chemical Engineering Laboratory II: 1 semester hour.
Chemical engineering laboratory directed to separation processes such as gas absorption, fractional distillation, extraction, and drying. Study of reaction rates and equilibria in simple chemical systems. Emphasis is placed upon experimental data required for the scale-up to commercial scale equipment.
Prerequisites: (CHEG 3302 or CHEG 3023) and (CHEG 3304 or CHEG 3053) and (COMM 1311 or COMM 1003 and (ENGL 1302 or ENGL 1133) or ENGL 2311 or ENGL 1143) and (PHYS 2125 or PHYS 2511) and (PHYS 2126 or PHYS 2521) and (CHEM 1112 or CHEM 1021).

CHEG 4104 Chemical Engineering Laboratory III: 1 semester hour.
Chemical engineering laboratory with emphasis on reactive and control systems. Measurement of reaction conversion, determination of reaction order and rate in a tubular reactor. Analysis of the dynamic responses of stirred tanks in series. Experimental study of the use of analog and digital controller for heat exchanger and flow and level control systems.
Prerequisites: CHEG 4303 or CHEG 4033 and (COMM 1311 or COMM 1003 or SPCH 1003) and (ENGL 1302 or ENGL 1133 or ENGL 1143 or ENGL 2311) and (PHYS 2125 or PHYS 2511) and (PHYS 2126 or PHYS 2521) and (CHEM 1112 or CHEM 1021).

CHEG 4247 Senior Design and Professionalism -I: 2 semester hours.
This is the first course of a two-semester capstone experience (CHEG 4248 must immediately follow 4247 or sequence must restart with 4247) involving engineering design of an industrial or advanced team project. Elements of ethics and professionalism in engineering practice are integrated into the project experience. The project will include application of relevant engineering codes and standards, as well as realistic constraints. Design achievements are demonstrated with written reports, and oral presentation, and professional standards and ethics examinations.
Prerequisites: (CHEG 3301 or CHEG 3013) and (CHEG 3023 or CHEG 3302) and (CHEG 3043 or CHEG 3305) and (CHEG 3063 or CHEG 3306).

CHEG 4248 Senior Design and Professionalism - II: 2 semester hours.
A continuation of CHEG 4247 with required design modifications of the team projects necessary to produce a working prototype of the designs initiated in Senior Design and Professionalism I. Design project deliverables include an oral presentation, as well as a final written report. Professionalism education will, and a formal demonstration of prototype, or model, of the design. Elements of professionalism reinforce the importance of professional engineering ethics, corporate culture, life-long learning, and globalization.
Prerequisites: CHEG 4247 or CHEG 4472.

CHEG 4303 Process Dynamics and Control: 3 semester hours.
Dynamic response and control of chemical process equipment such as reactors, heat exchangers, distillation columns. Use is made of fundamental techniques of servomechanism theory such as block diagrams, transfer functions, and frequency response; stability analysis and control loop design. Unsteady state modeling and computer simulation of simple control systems.
Prerequisites: (CHEG 3306 or CHEG 3063) and (MATH 4317 or MATH 4173).

CHEG 4304 Chemical Process Design and Analysis: 3 semester hours.
Use of material and energy balance calculations, thermodynamics, transfer operations, reaction kinetics and process economics for the synthesis and analysis of chemical processing systems. Design alternatives are analyzed by the use of case studies, computerized flow sheet modeling and simulation, and optimization methods. Safety and design codes are emphasized.
Prerequisites: (CHEG 3301 or CHEG 3013) and (CHEG 3302 or CHEG 3023) and (CHEG 3305 or CHEG 3043) and (CHEG 3306 or CHEG 3063).

CHEG 4310 Special Topics in Chemical Engineering: 3 semester hours.
This course presents selected current and emerging topics in chemical engineering depending on need as determined by the department faculty.

CHEG 4312 Process Safety Engineering Fundamentals: 3 semester hours.
This course addresses aspects of chemical process safety and loss prevention, such as identification of potential hazards and hazardous conditions associated with processes and equipment involved in the chemical process industries. It includes methods of predicting the severity of the associated hazards and preventing, controlling or mitigating them. It emphasizes quantitative engineering analysis; techniques for performing process hazard analysis, risk assessment, and accident investigation are introduced.

CHEG 4313 Process Modeling and Simulation: 3 semester hours.
Construction and solution of mathematical models of process units and integrated systems for computer simulation. Both steady and dynamic models will be developed. Students will make use of one or more of the commercial flow sheet simulation programs for the analysis of specific systems.

CHEG 4315 Bioengineering: 3 semester hours.
Design and analysis of biochemical systems with applications in biomedical engineering and metabolic processes, enzyme catalyzed reactions and product separation, biomass production, and wastewater treatment. Emphasis is placed upon the application of biochemical systems structure, reaction kinetics, transport processes, and control in the design and use of biochemical reactors and separation units.

CHEG 4318 Design of Process Engineering Systems: 3 semester hours.
The course will stress the interdisciplinary nature of systems design and will include structural, hydraulic, process, utilities and control concepts. Development of one or more selected applications in optimal design of continuous and batch systems. Studies will involve the use of computer-aided design, cost estimation, engineering data bases, and project scheduling.
Prerequisites: CHEG 3301 or CHEG 3013 and (CHEG 3302 or CHEG 3023) and (CHEG 3304 or CHEG 3053) and (CHEG 3306 or CHEG 3063).

CHEG 4321 Nuclear Science Fundamentals: 3 semester hours.
An interdisciplinary survey course introducing the basics of atomic and nuclear science, radiation physics and their relation to engineering problems and applications. Specific applications to nuclear materials, nuclear safety, nuclear forensics, radiation detection, radiation safety, and radiation effects on humans and technology. Technical background assumed is the standard physics, mathematics and chemistry required for an undergraduate engineering degree.

CHEG 4322 Nuclear Forensic Analysis: 3 semester hours.
The course introduces methods important to the investigation of nuclear materials to identify the source, trafficking mode, and level of enrichment of particular nuclear materials recovered from various sources such as dust at a nuclear facility locale, or post-nuclear explosion debris. Topics include radiochemistry review, nuclear applications for power and defense, contemporary issues in forensics and proliferation, methods for forensics analysis, and case studies.

CHEG 4399 Independent Study: 1-3 semester hour.
Readings, research and/or field work on selected topics. This course is intended as a curriculum supplement for highly motivated students with special areas of interest. An individualized course of study, planned by student and advisor, is executed under the direction of the advisor.

CHEG 5301 Advanced Reaction Engineering: 3 semester hours.
Rates and mechanisms of chemical reactions. Thermo and catalytic reactions both homogeneous and heterogeneous with applications. Applications to design of new materials.

CHEG 5302 Microelectronics Materials: 3 semester hours.
Heterogeneous chemical reactions. Chemical engineering aspects of materials fabrication and processing. CVD thin film deposition techniques. Preparation of superconducting powders. Composites. Modeling and practical applications.

CHEG 5303 Environmental Processes: 3 semester hours.
Fundamentals of environmental engineering, chemistry, physical-chemistry and transport properties. Energy and mass balances. Reactions and reactors. Biological processes. Bioremediation.

CHEG 5304 Remediation Technologies: 3 semester hours.
Fundamentals of environmental remediation. Physical-chemical processes. Bioremediation. Stabilization and solidification. Thermal methods. Site characterization. Risk assessment. Containment. Remedial Alternatives Applications to real contaminated sites.

CHEG 5305 Chemical Engineering Thermodynamics: 3 semester hours.
This is a survey course starting with a review of thermodynamic laws then proceeding to examine ways that thermodynamics apply to various systems from static to dynamic, inert to reactive, and ultimately from abiotic to living systems. The approach will be to engage in readings (articles, book chapters, media releases), viewings (lectures, photos, videos), discussion (face to face and web assisted), and project based design and evaluation activities.

CHEG 5306 Transport Phenomena: 3 semester hours.
Transport Phenomena provides a unified treatment of momentum, mass, and energy transport in chemical engineering problems. Vector and tensor notations and mathematics will be used in expressing equations of continuity, motion, energy. Further develops the foundations of transport phenomena to apply this knowledge to the solution of problems of interest to the engineer.

CHEG 5311 Petroleum Engineering: 3 semester hours.
This course examines the petroleum industry and petroleum engineering including nature of oil and gas reservoirs, petroleum exploration and drilling, formation evaluation, well completions and production, surface facilities, reservoir mechanics, and improved oil recovery.

CHEG 5312 Process Safety Engineering: 3 semester hours.
This course addresses multiple aspects of chemical process safety and loss prevention in chemical manufacturing. Includes methods of predicting severity of hazards and preventing/controlling/mitigating them. Emphasizes quantitative engineering analysis based on applications of engineering principles.

CHEG 5321 Nuclear Science: 3 semester hours.
The objective of this course is to explore the fundamental aspects of nuclear and radiochemistry, with emphasis on the determination of radioactive species and the application of nuclear processes, radioactive materials, and radiochemical techniques in major applications such as medicine, nuclear power, national defense, and threat reduction.

CHEG 5322 Nuclear Forensics: 3 semester hours.
This course develops nuclear forensic skills needed for potential future terrorist attempted or actual events. Students learn to answer the questions where did the nuclear material come from (attribution), what routed did it follow to the interdiction site (route attribution), what route did it follow to the interdiction site (route attribution), how to safely collect nuclear materials for an interdiction site, how nuclear materials (pre-detonation and post-detonation) are analyzed, how to evaluate of pre-detonation nuclear materials' capabilities and how to interface with emergency response, law enforcement (FBI, UHP), Intelligence community, State Department and International Treaties.

Computer Information Systems Courses

CINS 5301 Information Resources Management: 3 semester hours.
Topics include information systems analysis, design, application, operation, management, and methods for integrating information resources into a decision support framework.

CINS 5304 Data Communications and Computer Networks: 3 semester hours.
A broad introduction to network technologies, architectures, services, and management necessary to meet business needs, including network and internet designs, applications, and an overview of the telecommunications industry.

CINS 5305 Database Management Systems: 3 semester hours.
Fundamentals of database management systems, techniques for the design of databases, and principles of database administration. The course emphasizes theories of data modeling, database design, database application development, and database management. Topics include conceptual models, query languages, and centralized, distributed, and client/server architectures. Special importance is assigned to the design of databases and the development of client/server architectures. Other topics include database integrity, security, error recovery, and concurrency control.
Prerequisites: COMP 1224 or COMP 1422.

CINS 5306 Data Structures and Algorithms: 3 semester hours.
Advanced course in data structures with an emphasis on common applications such as pattern matching, data compression, and spell checking. The goals are to provide an insight into data structures, to show how to evaluate data structures, and to provide a basis for making wise choices of data structures in the development of software application systems. The course relates the principles of data structures to the implementation of commercial applications and widely used utilities such as diff (for finding the string edit distance), grep (for pattern matching), and compress (for data compression).
Prerequisites: CINS 1224 or CINS 1422.

CINS 5307 Information Technology: 3 semester hours.
Introductory graduate-level course for CIS majors. This course explores the "information technology (IT) infrastructure," that is, the complex system of computers, networks, software, and delivery goals which collectively form the platform for assimilating and delivering information products and services to an organization and its customers, clients, and suppliers.

CINS 5317 Information Retrieval: 3 semester hours.
An introduction to information retrieval theory and algorithms. The topics include indexing, vector space models, evaluation, probabilistic and language models, web search engine, text classification, link analysis, XML retrieval, etc. with their implementation and applications.
Prerequisites: CINS 5306 or CINS 5063.

CINS 5318 Software Engineering: 3 semester hours.
Specifying software requirements and an overview of analysis and design techniques that can be used to structure applications. Topics in software requirements include interacting with end-users to determine needs and expectations, identifying functional requirements, and identifying performance requirements. Analysis techniques include prototyping, modeling, and simulation. Design topics include the system lifecycle, hardware and software trade-offs, subsystem subsystem definition and design, abstraction, information hiding, modularity, and reuse.
Prerequisites: CINS 5306 or CINS 5063.

CINS 5319 Enterprise Information Systems: 3 semester hours.
Introduce Business Processes used in common information systems such as Human Resources, Customer Relationship Management, Supply Chain Management, Enterprise Resource Planning, and Knowledge Management Systems. Students learn the development of modules using open source systems.
Prerequisites: CINS 5063 or CINS 5306 and (CINS 5033 or CINS 5305).

CINS 5330 E-Commerce: 3 semester hours.
The evolution of electronic commerce, where business is conducted between organizations and individuals relying primarily on digital media and transmission. Participants will investigate the opportunities and challenges of exchanging goods and services over communications networks as well as the manner in which business relationships are being reshaped. Course activities are designed to provide both managerial and entrepreneurial assessments of anticipated advances in information technology with respect to business systems and electronic markets.

CINS 5331 Information Assurance: 3 semester hours.
Topics include information security engineering, introduction to various information and Internet attack, defense technologies, operating system vulnerabilities and safeguards, and cryptography.
Prerequisites: (CINS 5304 or CINS 5043) and (CINS 5306 or CINS 5063).

CINS 5338 Software Project Management: 3 semester hours.
The course provides an in depth examination of software project management principles and activities. Methods for managing and optimizing software development process are discussed, along with techniques for managing software products from concept through development.
Prerequisites: CINS 5305 or CINS 5033 and (CINS 5306 and CINS 5063).

CINS 5391 Masters Project: 3 semester hours.
A candidate for the Master of Science in Computer Information Systems with project option is required to perform a study, design, or investigation, under the direction of a graduate faculty advisor. An oral presentation and a written report are required. Prerequisite: candidacy for the Non- Thesis-Option of the Master of Science in Computer Information Systems.

CINS 5690 Master Thesis: 6 semester hours.
A candidate for the Master of Science in Computer Information Systems with thesis option is required to perform a study, a design or investigation, under the direction of a faculty advisory committee. A written thesis is required to be presented, defended orally and submitted to the faculty advisory committee for approval.

Computer Science Courses

COMP 1101 Intro to Basic Engr & Comp Sci: 1 semester hour.
Students will become aware of the various disciplines of engineering, computer science and technology, ethical and professional responsibilities in these fields, creativity and design.
Prerequisites: COMP 1021 or COMP 1102.
Co-requisite: GNEG 1010.

COMP 1102 Introduction to Computer Science Lab: 1 semester hour.
This lab component will cover the overview of the current job opportunities and some hands-on exercises to understand the current topics.
Prerequisites: COMP 1101 or COMP 1011.

COMP 1121 Computer Science Lab I: 1 semester hour.
A laboratory course in programming for computer science utilizing the concepts introduced in COMP 1213, including language concepts of input/output, constants, data types, control structures, loops, functions, enumerated data types, arrays and strings structures, exception handling.
Prerequisites: (MATH 1316 (may be taken concurrently) or MATH 1123 (may be taken concurrently)) or (MATH 1511 (may be taken concurrently) or MATH 1115 (may be taken concurrently)) or (MATH 2413 (may be taken concurrently) or MATH 1124 (may be taken concurrently)).
Co-requisite: COMP 1336.

COMP 1122 Computer Science Lab II: 1 semester hour.
A laboratory course in programming for computer science utilizing the concepts in COMP 1223 in object-oriented programming concepts including classes, abstraction, data hiding, polymorphism, inheritance; as well as basic programming data structures including array based lists, pointers, basic linked lists, stacks and queues.
Prerequisites: (COMP 1336 or COMP 1213) and (COMP 1121 or COMP 1211) and (MATH 2413 (may be taken concurrently) or MATH 1124 (may be taken concurrently)).
Co-requisite: COMP 1337.

COMP 1300 Digital Communication: 3 semester hours.
Efficient communication in the digital world, including multi-media editing, web page/site design, publishing on the internet, and cloud computing. Social and ethical responsibility of using social media, surfing the internet, and information security. Fundamentals of Excel spreadsheets and MS Access together pertinent information analyzed, evaluate, interpret, display data, and draw conclusion. Team projects using Sharepoint and group presentation.

COMP 1315 Introduction to Computer Science: 3 semester hours.
Fundamentals of computer science and programming to include algorithm definition, concepts, semantics and logic, fundamental data types (character, integer, and floating-point) and their binary representations and limits, arithmetic and logical operators and precedence, program structure and flow, branching and looping, functions and parameters, and basic input and output methods, emphasizing modular design and implementation of an object-oriented language such as C++.

COMP 1336 Computer Science I: 3 semester hours.
Introduction to and practice of modern problem solving and programming methods. Special emphasis is placed on top-down modular design and implementation of robust and easily maintainable programs in a high-level, object-oriented language such as C++ to include external files, control structures, loops, scope, functions, output formatting, inline functions and function templates, enumerated data types, arrays, structures, exception handling.
Prerequisites: (MATH 1115 or MATH 1511) or (MATH 1123 or MATH 1316) or (MATH 1124 or MATH 2413).
Co-requisite: COMP 1121.

COMP 1337 Computer Science II: 3 semester hours.

COMP 1422 Computer Science and Laboratory II: 4 semester hours.
Continuation of COMP 1214 with continued emphasis on program development techniques, array based lists, pointers, basic linked lists, classes, abstraction, data hiding, polymorphism inheritance, stacks and queues.
Prerequisites: COMP 1336 or COMP 1213 and (COMP 1121 or COMP 1211).
Co-requisite: MATH 2413.

COMP 2300 Introduction to Web Design and Multimedia: 3 semester hours.
The role of internet and as a tool in business; design and development of simple internet applications using HTML; basics of scripting languages; development of home pages incorporating graphics, and multimedia.

COMP 2302 Applications Development using C#: 3 semester hours.
Introduction to developing Windows based applications using the Visual Studio C# language. Students will learn how to develop software for several types of (fun) applications using interactive forms, multimedia, graphics, images, Web services, streaming video, etc. Basics of developing simple games, incorporating web services such as Mapping, weather, You-tube, stock quotes, etc. will also be covered. Open to all majors.
Prerequisites: COMP 1013 or COMP 1315 or COMP 1213 or COMP 1336.

COMP 2303 Assembly Language: 3 semester hours.
Study of the logical design and internal operation of digital computers and programming using a macro assembly language. Using several practical exercises to illustrate machine structures and programming techniques for a typical microprocessor environment, such as the Intel processor/IBM PC architecture.
Prerequisites: COMP 1422 or COMP 1224.

COMP 2310 Discrete Structures: 3 semester hours.
A bridge course between data structures/discrete mathematics and analysis of algorithms, to include reviews of functions and relations, basic combinatorics (set operations, counting, combinations, and permutations) and introductions to prepositional and predicate logic, discrete probability theory, recursive definitions, computational complexity, and proof techniques including mathematical induction. The concepts are illustrated by applications involving graphs, trees, networks and related algorithms.
Prerequisites: (COMP 1422 or COMP 1224) or ((COMP 1221 or COMP 1122) and (COMP 1337 or COMP 1223)).

COMP 2313 Introduction to Information Security: 3 semester hours.
Expose students to the concept of network security and make them aware of related information security and privacy problems. Topics in network security includes malware, social engineering attacks, Web application attacks, wireless security, access control, authentication, basic cryptography, and security in social medial and cloud computing. Various attack demonstrations and animations will be utilized. This course can be used as low-level CS elective.
Prerequisites: COMP 1422 or COMP 1224.

COMP 2314 Introduction to Java: 3 semester hours.
An introduction to the Java Programming language. Includes coverage of Java Development Kit (JKD), applications, creating applets for enhancing web pages, and an introduction to the object model, and object oriented programming. Prerequisites: Proficiency in at least one programming language. Can be used as a computer science lower level elective.

COMP 2315 Python Programming Language: 3 semester hours.
An introduction to the fundamentals of python programming. It covers various topics, including variables and data types, functions, file input and output, and recursion. Packages for data processing and analytics such as Numpy, Scipy, Pandas, Scikit-learn, and Matplotlib will be introduced. Students will program using popular platforms like PyCharm and Jupyter notebook.
Prerequisites: COMP 1337 or COMP 1223.

COMP 2319 Computer Organization: 3 semester hours.
The study of a computer as a series of levels, each one built on its predecessor. Digital logic level, the microprogramming level, the conventional machine level, the operating systems level, and the assembly language level.
Prerequisites: COMP 1337 or COMP 1223 and (COMP 1122 or COMP 1221).

COMP 2336 Data Structures: 3 semester hours.
Fundamental data structures; the implementation and application of binary files, stacks, queues, recursion, advanced linked lists, trees, graphs, data compression, heap, priority queue, and sorting techniques.
Prerequisites: (COMP 1422 or COMP 1224) or (COMP 1337 or COMP 1223) and (COMP 1122 or COMP 1221).

COMP 3301 Embedded Systems: 3 semester hours.
Examines how to design, program, and test embedded systems that interact with the physical world. Topics include microcontrollers, hardware interfacing, sensors, and real time programming.
Prerequisites: COMP 2336 or COMP 2013.

COMP 3303 Digital Logic Circuits: 3 semester hours.
The design and implementation of digital logic circuits. Combinational and sequential circuit analysis. Digital circuit design optimization methods using random logic gates, multiplexers, decoders, registers, counters, and programmable logic arrays.
Prerequisites: COMP 2303 or COMP 2033.

COMP 3305 Analysis of Algorithms: 3 semester hours.
Introduction to algorithm design and analysis, computational complexity, and NP-completeness theory, emphasizing design, appropriate algorithms and data structures to solve a given problem efficiently, including divide- and-conquer techniques, greedy methods, and dynamic programming.
Prerequisites: (COMP 2336 or COMP 2013) and (COMP 2310 or COMP 2103).

COMP 3306 Operating Systems: 3 semester hours.
Basic functions of operating systems including device management, multi-programming, job management, memory management, and input/output processing.
Prerequisites: COMP 2336 or COMP 2013 and (COMP 2319 or COMP 3304 or COMP 3043).

COMP 3311 Introduction to Data Science: 3 semester hours.
This course introduces students to Big Data and Data Analysis techniques. Topics covered include data science and analytics, introduction to programming languages suitable for data analysis, ,data explorations, visualization technique for large datasets and basics of machine learning. The course consists of weekly lectures followed by hands-on labs.
Prerequisites: COMP 1337 or COMP 1223.

COMP 3321 Graphics and Visual Computing: 3 semester hours.
Principles of interactive computer graphics; Topics include fundamental techniques in graphics, graphic systems, graphic communication, geometric modeling, rendering, computer animation, visualization and virtual reality and other recent developments in computer graphics.
Prerequisites: COMP 2336 or COMP 2013.

COMP 3322 Software Engineering: 3 semester hours.
Formal software development, including the software life-cycle, modular and top-down design, validation and verification, and maintainable systems.
Prerequisites: COMP 2336 or COMP 2013.

COMP 3331 Information Privacy: 3 semester hours.
An introduction to the fundamentals of information privacy. It covers various topics, including data anonymization, differential privacy, location privacy, web and network privacy; multiparty computation, privacy in internet of Things; privacy in social networks, and secure data outsourcing. The course also provides students with hands-on experience in information privacy.
Prerequisites: COMP 2336 or COMP 2013.

COMP 3332 Cryptography: 3 semester hours.
An introduction to the fundamentals of cryptography. It covers various topics, including classic data encryption and decryption schemes, private and public key systems, message authentication, digital signature, and hash function. The course also provides students with hands-on experience in cryptograph.
Prerequisites: COMP 2310 or COMP 2103.

COMP 3333 Smart Device App Development: 3 semester hours.
Introduction to app development for smart devices, specifically for Apple iOS or Google Android devices. Differences between smart devices and traditional desk top computer systems will be examined. Various app development environments will be covered, including Xcodc and programming language Objective-C for iOS, and Eclipse for Android.
Prerequisites: COMP 2013 or COMP 2336.

COMP 3343 Internet of Things: 3 semester hours.
Introduction to the Internet of Things(IoT), evolution and market around Internet of things, embedded systems and distributed systems to support IoT devices, communication and data storage in IoT, IoT design considerations and constraints, current components of IoT and future trends. The goal of this course is to help students with solid technical knowledge and skills to build IoT systems from the ground up. The course will focus on creative thinking and on hands-on project development.
Prerequisites: COMP 2013 or COMP 2336.

COMP 3395 Database Management: 3 semester hours.
File structures and access methods, database modeling design and user interface, components of database management systems. Information storage and retrieval, query languages, high-level language interfaces with database systems.

COMP 4100 Ethics and Social Issues in Computing: 1 semester hour.
Social and ethical implications of computing. Topics include history of computing, social context of computing, methods and tools of analysis, professional and ethical responsibilities, risks and liabilities of computer-based systems, intellectual property, privacy and civil liberties.

COMP 4107 Computer Science Special Topic: 1 semester hour.
This special topic course covers critical topics and skills, such as tech-interview, start-up tech entrepreneurship, emerging new tech development seminar, etc.

COMP 4207 Senior Design Project I: 2 semester hours.
A first of a two-part senior design course for computer science majors. Students will study computer systems design working as a design-team member, conceptual design methodology, design evaluations, project planning and management techniques, design optimization, systems manufacturing, cost considerations with an emphasis on students' activities as design professionals.
Prerequisites: COMP 3322 or COMP 3223 and (COMP 3306 or COMP 3063) and (COMP 3305 or COMP 3053) and (COMP 3395 or COMP 3953).
Co-requisite: COMP 4100.

COMP 4208 Senior Design Project II: 2 semester hours.
A continuation of COMP 4072 giving students the opportunities to complete a design project, make formal presentation, research, proposal writing, patents, and literature searches.
Prerequisites: COMP 4207 or COMP 4072.

COMP 4307 Special Topics: 1-3 semester hour.
Studying selected current and emerging topics in Computer Science. Courses may be repeated for credit when topics vary.

COMP 4311 Programming Languages: 3 semester hours.
Overview of programming languages, syntactic and semantic specification, virtual machines and fundamental issues in language design, analyzing of the imperative, object-oriented, functional, and declarative language paradigms. Introduction to formal grammars, including Backus-Naur notation studying the formal theory behind the design of a programming languages. Several programming languages will be analyzed.

COMP 4312 Computer Networks: 3 semester hours.
Introduction to the networking of computer systems to include the study of local area (LAN) and wide area (W AN) networks, data transmission, communications software, the architecture of networks, and network communication protocols.
Prerequisites: COMP 3306 or COMP 3063.

COMP 4314 Introduction to Parallel Computing: 3 semester hours.
Students will study modern parallel computer architectures and the major parallel programming models in both shared and distributed systems. Topics include parallelism, concurrency, partition, divide-and-conquer, synchronization, load balancing, parallel algorithm design, implementation, and debugging.
Prerequisites: (COMP 2336 or COMP 2013) and (COMP 2310 or COMP 2103).

COMP 4315 Data Mining and Analytics: 3 semester hours.
Topics cover fundamental data mining and analytical algorithms and paradigms, including supervised learning, unsupervised learning, frequent pattern mining, link analysis, performance improvement through data interaction, etc. Focus on implementation and data visualization using modern programming languages in the knowledge discovery process. Latest concepts such as big data and social media are also discussed.
Prerequisites: MATH 3302 or MATH 3023 and (MATH 3307 or MATH 3073).

COMP 4316 Machine Learning: 3 semester hours.
Topics cover fundamental machine learning algorithms and paradigms including information-based learning, probability-based learning, instance-based learning, error-based learning, neural networks and deep learning, unsupervised learning, etc. Focus on implementation and data visualization using modern programming languages such as Python and R.
Prerequisites: (COMP 2336 or COMP 2103) or (COMP 2013 or COMP 2336).

COMP 4317 Formal Languages and Automata: 3 semester hours.
Introduction to formal grammars, including Backus-Naur notation studying the formal theory behind the design of a computer language. The corresponding types of automata that will serve as recognizers and generators for a language will be described.
Prerequisites: COMP 2310 or COMP 2103.

COMP 4318 Information Retrieval: 3 semester hours.
An introduction to information retrieval theory and web searching algorithms. The topics include indexing, vector space models, evaluation, probabilistic and language models, web search engine, text classification, link analysis, web crawling, etc., with their implementation and applications.
Prerequisites: COMP 2336 or COMP 2013 and (MATH 3302 or MATH 3023).

COMP 4323 Network Security: 3 semester hours.
Address the fundamentals of network security, including compliance and operational security; threats and vulnerabilities; application, data and host security; access control and identity management; and cryptography. Topics includes psychological approaches to social engineering attacks, Web application attacks, penetration testing, data loss prevention, cloud computing security, and application programming development security.
Prerequisites: COMP 4312 or COMP 4123.

COMP 4331 Computer Forensics: 3 semester hours.
An introduction to the fundamentals of computer forensics, it covers various topics, including cyber crimes, evidence extraction and control, data recovery, network forensics, mobile platform forensics, software reverse engineering, and legal issues. The course also provides students with hands-on experience in digital forensics.
Prerequisites: COMP 3306 or COMP 3063.

COMP 4332 Mobile Security: 3 semester hours.
introduction to the principles of mobile security. It covers various topics, including wireless and mobile network security, security models of mobile device platforms, mobile service security, and security of the Internet of Things. The course also provides students with hands-on experience in the security of various mobile systems.
Prerequisites: COMP 2336 or COMP 2013.

COMP 4333 Ethical Hacking and Penetration Testing: 3 semester hours.
This course teaches students the underlying principles and many of the techniques associated with the cyber-security practice known as penetration testing or ethical hacking. The course also provides students with hands-on experience on this topic.
Prerequisites: (COMP 3063 or COMP 3306) and (COMP 4123 or COMP 4312).

COMP 4384 Human-Computer Interaction: 3 semester hours.
Focuses on the dynamics of human-computer interaction (HCI). Provides a broad overview of HCI as a sub-area of computer science and explores user-centered design approaches in information systems applications. Addresses the user interface and software design strategies, user experience levels, interaction styles, usability engineering, and collaborative systems technology. Students will perform formal software evaluations and usability tests.
Prerequisites: COMP 3322 or COMP 3223.

COMP 4395 Data Base Management: 3 semester hours.
File structures and access methods, database modeling design and user interface, components of database management systems. Information storage and retrieval, query languages, high-level language interfaces with database systems.
Prerequisites: COMP 2336 or COMP 2013.

COMP 5129 Research: 1 semester hour.
Topics cover literature review and summarization, scientific article writing, problem analysis and formulation, references and citation.

COMP 5300 Research Methods and Graduate Seminar: 3 semester hours.
Series of lectures given by faculty and by visiting computer and information scientists and information technologists.

COMP 5311 Fundamentals and Concepts of Programming Languages: 3 semester hours.
Study of the principles that form the basis of programming language design. Research topics in high-level languages including data abstraction, parameterization, scoping, generics, exception handling, parallelism, and concurrency. Additional topics include alternative language designs (imperative, functional, descriptive, object-oriented, and data flow designs) and an overview of interfacing with support environments.
Prerequisites: COMP 4311 or COMP 4113.

COMP 5312 Advanced Computer Architecture: 3 semester hours.
New technological developments, including details of multiprocessor systems and specialized machines. The main focus is on the quantitative analysis and cost-performance tradeoffs in instruction set, pipeline, and memory design. Descriptions of real systems and their performance data are also given. Topics covered include quantitative performance measures, instruction set design, pipelining, vector processing, memory organization, input/output methods, and an introduction to parallel processing.
Prerequisites: COMP 3304 or COMP 3043.

COMP 5313 Advanced Operating Systems: 3 semester hours.
Theoretical and practical aspects of operating systems, including an overview of system software, time-sharing and multiprogramming operating systems, network operating systems and the Internet, virtual memory management, inter-process communication and synchronization, and case studies.
Prerequisites: COMP 3306 or COMP 3063.

COMP 5314 Advanced Database Management System: 3 semester hours.
Topics related to database design and data management in a database environment, including data normalization, functional dependencies, database design, query language design, implementation constraints, data integrity and security, and distributed data processing. The emphasis is on the concepts and structures necessary to design and implement a database management system. Selected advanced topics such as distributed databases, object-oriented databases, real-time databases, and multimedia databases will be discussed. Because of the many advances in information technology and the database development techniques, new business needs and opportunities are constantly emerging and, with them, the need to manage new technologies and applications effectively. This course explores these new application areas and the management approaches needed to make them successful.
Prerequisites: CINS 5033 or CINS 5305.

COMP 5315 Design and Analysis of Algorithms: 3 semester hours.
Introduction to algorithm design and analysis, computational complexity, and NP-completeness theory. The course emphasizes how to design and choose appropriate algorithms and data structures to solve a given problem efficiently. Design methods covered include divide-and-conquer techniques, greedy methods, and dynamic programming. Problem domains covered include string matching, polynomials and matrices, graph theory, optimal trees, and NP-hard problems.
Prerequisites: COMP 3305 or COMP 3053.

COMP 5316 Artificial Intelligence: 3 semester hours.
An introduction to artificial intelligence. The topics include intelligent agents, problem solving through search, knowledge representation and reasoning, planning, probabilistic reasoning and models, reinforcement learning, and their applications.
Prerequisites: COMP 2336 or COMP 2013 and (MATH 3302 or MATH 3023).

COMP 5317 Computer Vision: 3 semester hours.
An introduction to the principles of computer vision. It covers various topics, including fundamentals of image formation, feature detection and matching, motion estimation and tracking, image classification, and deep learning with neural networks. The course also provides students with hands-on experience in developing computer vision algorithms.
Prerequisites: COMP 2336 or COMP 2013.

COMP 5324 Distributed Computing and Parallel Processing: 3 semester hours.
Comprehensive introduction to the field of parallel and distributed computing systems, including algorithms, architectures, networks, systems, theory, and applications. Distributed parallel computation models, and the design and analysis of parallel algorithms will be emphasized.
Prerequisites: COMP 5313 or COMP 5133.

COMP 5326 Machine Learning: 3 semester hours.
An introduction to machine learning theory and techniques including supervised and unsupervised learning, learning models, theoretical and empirical evaluation. Topics include decision tree, Bayesian learning, instance-based learning, regressions, support vector machine, neural networks, deep learning, reinforcement learning, etc.
Prerequisites: COMP 2336 or COMP 2013 and (MATH 3302 or MATH 3023).

COMP 5327 Data Mining: 3 semester hours.
Data Mining Studies algorithms, paradigms to find patterns and regularities in databases, perform prediction and forecasting, and improve their performance through data interaction. The knowledge discovery process includes data selection, cleaning, coding, and visualization. Data warehousing is also discussed.
Prerequisites: COMP 4953 or CINS 5033.

COMP 5328 Natural Language Processing: 3 semester hours.
An introduction to the natural language processing theory, including language models, automatic syntactic processing, semantic processing, discourse, and pragmatics. This course will cover typical applications of natural language processing, such as information extraction, sentiment analysis, question answering, and machine translation.
Prerequisites: COMP 2336 or COMP 2013 and (MATH 3302 or MATH 3023).

COMP 5329 Text Mining: 3 semester hours.
Study text mining principles for high-quality information retrieval, including text structuring, patterns deriving, interpretation of the output, and empirical evaluation of the algorithms. Topics cover data analysis, text categorization, text clustering, concept extraction, text summarization, sentiment analysis, topic models, etc., with their implementation and applications.
Prerequisites: (COMP 2336 or COMP 2013) and (MATH 3302 or MATH 3023).

COMP 5332 Computer and Network Security: 3 semester hours.
Survey of various computer attacks, viruses, malware, and operating system vulnerabilities and safeguards. Emphasis will be put on defense techniques and skills. A study of problems related to data communication and networking security; databases security; authorization mechanisms for systems with shared resources; cryptography and applications.
Prerequisites: (CINS 5043 or CINS 5304 or COMP 4312 or COMP 4123) and (CINS 5063 or CINS 5306 or COMP 3053 or COMP 3305).

COMP 5342 Software Engineering Processes: 3 semester hours.
Engineering of complex systems that have a strong software component. Topics include deriving and allocating requirements, system and software architectures, systems analysis and design, integration, interface management, configuration management, quality, verification and validation, reliability, and risk.
Prerequisites: COMP 2336 or COMP 2013 or CINS 5063 or CINS 5306.

COMP 5389 Applied Research: 3 semester hours.
A realistic experience in Computer Science to enhance the student's professional abilities. Students work on significant projects with industry firms or governmental agencies involving decision-making responsibility. Course requires oral and written report.

COMP 5391 Masters Project: 3 semester hours.
A candidate for the Master of Science in Computer Science with project option is required to perform a study, design, or investigation, under the direction of a graduate faculty advisor. An oral presentation and a written report are required. Prerequisite: candidacy for the Non-Thesis option of the Master of Science in Computer Science.

COMP 5690 Masters Thesis: 6 semester hours.
A candidate for the Master of Science in Computer Science with thesis option is required to perform a study, a design or investigation, under the direction of a faculty advisory committee. A written thesis is required to be presented, defended orally and submitted to the faculty advisory committee for approval.

Civil Engineering Courses

CVEG 1101 Intro Engineering & Comp Sci: 1 semester hour.
Introduction to basic engineering, computer science and technology concepts. Students will become aware of the various disciplines of engineering, computer science and technology, ethical and professional responsibilities in these fields, creativity and design.
Co-requisites: CVEG 1102, GNEG 1010.

CVEG 1102 Introduction to Civil Engineering Lab: 1 semester hour.
Introduction to Civil Engineering as a profession, identification and discussion of the sub-fields of Civil Engineering, ethical responsibilities in engineering practice, concepts of design, laboratory demonstrations and problem-solving exercises that emphasize critical thinking skills. Leadership principles, the importance of professional licensure, life-long learning and membership in ASCE are discussed.
Co-requisite: CVEG 1101.

CVEG 2100 Emerging Issues in Civil Engineering: 1 semester hour.
An overview of emerging issues and state-of-the-art technologies commonly used in Civil Engineering practice. Computer-aided drafting (CAD) software and techniques are presented. Basic concepts in leadership, teamwork and team building are emphasized. Problem solving and the communication of engineering solutions using appropriate engineering design documentation and drawings, and the importance of professional licensure are reinforced.
Prerequisites: CVEG 1101 or CVEG 1011 and (CVEG 1102 or CVEG 1021).

CVEG 2101 Materials and Dynamics Lab: 1 semester hour.
Determination of mechanical properties of engineering materials. Tensile testing, torsion, bending and deflection; standard testing methods and procedures; instrumentation and data acquisition techniques (for example using strain gages). Dynamics topics include: projectiles, conservation principles, linear and angular momentum, mass moment of inertia and vibration.
Prerequisites: (ENGL 1302 or ENGL 1133) or (ENGL 2311 or ENGL 1143) and (CVEG 2301 or CVEG 2043).

CVEG 2102 Surveying and Geospatial Concepts: 1 semester hour.
Introduction to plane surveying: leveling, horizontal distance and measurements, vertical and horizontal angles, azimuths and bearings, traverse calculations, earthwork and volume computations, stadia, topographical surveys, construction boundaries, coordinate systems; trigonometry applications in civil engineering and pertinent computer software. The Global Positioning System (GPS) and Geographic Information Systems (GIS) are introduced.
Prerequisites: (MATH 2413 or MATH 1124) and (CVEG 2304 or CVEG 2073).

CVEG 2301 Engineering Mechanics I: 3 semester hours.
Fundamental concepts and principles; vector algebra and applications; equilibrium of particles and rigid bodies in two and three dimensions, moments and couples; distributed forces, centroids, moments of inertia, friction, introduction to analysis of structures.
Prerequisites: PHYS 2325 or PHYS 2513.

CVEG 2302 Engineering Mechanics II: 3 semester hours.
Kinematics and kinetics of particles and of rigid bodies as applied to engineering problems; Newton's laws of motion; work and energy; impulse and momentum; translations; rotation; plane motion; motion about a point; general motions; and periodic motions.
Prerequisites: CVEG 2301 or CVEG 2043.

CVEG 2304 Global Development Issues: 3 semester hours.
An overview of global development issues and their importance. Global and regional developing goals, history, implementation and impact. Global and local dimensions o development, and the concept of sustainability. Ethical dimensions of development , management concepts for projects and related issues. Global issues related to energy, the environment , and the food-energy-water (FEW) nexus. Audience-appropriate visualization and documentation.

CVEG 2332 Mechanics of Materials: 3 semester hours.
Mechanical behavior of engineering materials, plane stress, plane strain, stress-strain relationship, shear and moment, torsion, flexural, column and combined loadings. Introduction to deflections; concepts of stresses at a point; stresses in pressured containers; and theories of failures and thermal stresses.
Prerequisites: ((CVEG 2301 or CVEG 2043) or (CVEG 2454 or CVEG 2400)) and (MATH 2414 or MATH 2024).

CVEG 2400 Statics and Dynamics: 4 semester hours.
Fundamental concepts; equilibrium of particles and rigid bodies; centroids; moments of inertia; friction; introduction to analysis of structures. Kinematics and Kinetics of particles and of rigid bodies; equations of motion; work and energy; impulse and momentum.
Prerequisites: PHYS 2325 or PHYS 2513.

CVEG 3100 Concrete and Steel Laboratory: 1 semester hour.
Hands-on experience in the design, fabrication and construction of concrete and steel prototypes and models, such as concrete beam, concrete canoe and steel trusses. Application of engineering mechanics and materials laboratory techniques and methods, testing, analysis of experimental results, and report writing.
Prerequisites: (CVEG 2332 or CVEG 2063) and (CVEG 2101 or CVEG 2061).

CVEG 3102 Professional Engineering I: 1 semester hour.
Fundamentals of engineering, related science subjects, including computers, engineering economics, ethics, fluid mechanics, mathematics, probability and statistics, statics, mechanics of materials. Civil and Environmental Engineering topics include: environmental, water resources, structures, materials, geotechnical, transportation, construction management and surveying.
Prerequisites: MATH 3302 or MATH 3023 and (MATH 4317 or MATH 4173) and (CVEG 3300 or CVEG 3023) and (CVEG 3100 or CVEG 3031) and (CVEG 3301 or CVEG 3043) and (CVEG 3302 or CVEG 3053) and (CVEG 3303 or CVEG 3063) and (CHEG 2308 or CHEG 2003).

CVEG 3300 Geotechnical Engineering: 3 semester hours.
Physical and mechanical properties of soil; moisture and its movement in soil; moisture density relationships; soil classification; settlement; consolidation; permeability; testing of soil physical and mechanical properties; and laboratory sessions.
Prerequisites: CVEG 2101 or CVEG 2061 and (CVEG 2332 or CVEG 2063).

CVEG 3301 Environmental Engineering: 3 semester hours.
Review of the environmental chemistry and biology, introduction to environmental science and engineering, material balance, reaction kinetics, reactor design, introduction to solid and hazardous waste, water and wastewater quality characteristics, laboratory analysis of water and wastewater samples.
Additional prerequisite: BIOL elective or course approved by the Department Head.
Prerequisites: (CHEM 1403 or CHEM 1034) or (CHEM 1303 or CHEM 1033) and (CHEM 1304 or CHEM 1043) and (CHEM 1112 or CHEM 1021) and (BIOL 1307 or BIOL 1073) or (BIOL 1308 or BIOL 1113) or (BIOL 1309 or BIOL 1123).

CVEG 3302 Transportation Engineering: 3 semester hours.
Principles of transportation engineering. Topics include: basic concepts in the planning, operation, management, and design of air, surface, and water transportation modal facilities; an introduction into the major aspects of regulatory requirements and economics related to transportation issues; and laboratory sessions in the various sub-areas of transportation engineering.
Prerequisites: MATH 2320 (may be taken concurrently) and (CHEG 2308 or CHEG 2003) and (CVEG 2102 or CVEG 2081) and (COMM 1311 or COMM 1003).

CVEG 3303 Hydraulics: 3 semester hours.
Fluid statics; pressure on submerged bodies; continuity equation; Bernoulli equation; principles of momentum and energy; fundamentals of hydraulic modeling; open channel flow; pressure conduit flow; flow measurement; laboratory sessions on selected topics.
Prerequisites: CVEG 2301 or CVEG 2043.

CVEG 3304 Structural Analysis: 3 semester hours.
Analysis of determinate structures; reactions, member forces of trusses, shears and bending moments of beams and frames; influence lines; moving loads; deflections; analysis of indeterminate structures by approximate method and energy method; computer application.
Prerequisites: CVEG 2332 or CVEG 2063.

CVEG 3305 Steel Design: 3 semester hours.
Analysis and design of tension and compression members, rolled steel beams, plate girders, riveted, welded, and pinned joints; and an introduction to design of trusses and multistory frames.
Prerequisites: CVEG 3304 or CVEG 3073.

CVEG 3600 Civil Engineering Internship I: 6 semester hours.
An internship program of work experience with an approved engineering oriented firm, agency or consulting firm or engineering public service agency serving the civil engineering profession. A comprehensive written report of the work-learning experience is required.

CVEG 4100 Geotechnical Engineering Design Laboratory: 1 semester hour.
Site investigation methods and the development of soil exploration reports, design of retaining structures, slope stability; design of shallow and deep foundations.
Prerequisites: CVEG 3300 or CVEG 3023.

CVEG 4200 Senior Design and Professionalism - I: 2 semester hours.
This is the first course of a two-semester capstone experience (CVEG 4482 must immediately follow 4472 or sequence must restart wit 4472) involving engineering design of an industrial or advanced team project. Elements of ethics and professionalism in engineering practice are integrated into the project experience. The project will include application of relevant engineering codes and standards, as well as realistic constraints. Design achievements are demonstrated with written reports, and oral presentation, and professional standards and ethics examinations.
Prerequisites: (CVEG 3300 or CVEG 3023) and (CVEG 3301 or CVEG 3043) and (CVEG 3302 or CVEG 3053) and (CVEG 3303 or CVEG 3063) and (CVEG 3304 or CVEG 3073).

CVEG 4201 Senior Design and Professionalism - II: 2 semester hours.
A continuation of CVEG 4472 with required design modifications of the team projects necessary to produce a working prototype of the designs initiated in Senior Design and Professionalism I. Design project deliverables include an oral presentation, as well as a final written report. Professionalism education will, and a formal demonstration of prototype, or model of the design. Elements of professionalism reinforce the importance of professional engineering ethics, corporate culture, life-long learning, and globalization.
Prerequisites: CVEG 4200 or CVEG 4472.

CVEG 4300 Reinforced Concrete: 3 semester hours.
Properties of concrete and reinforcement, design methods, codes, load, flexure, shear, bonds, and deflections, analysis and design of beams and columns; introduction to design of footings, slabs, and retaining walls; and introduction to computer-aided design.
Prerequisites: (CVEG 3100 or CVEG 3031) and (CVEG 3073 or CVEG 3304).

CVEG 4301 Environmental Engineering Design: 3 semester hours.
Synthesis of environmental engineering fundamentals into an integrated system design which includes the design of physical, chemical, and biological unit operations and processes in water and wastewater treatment.
Prerequisites: CVEG 3301 or CVEG 3043.

CVEG 4302 Transportation Engineering Design: 3 semester hours.
Introduction of the transportation design process through a series of comprehensive transportation design projects. Emphasis is placed on the utilization of existing facilities and creation of efficient new facilities through transportation systems management techniques. Energy, environment, mobility and community impacts are considered as measures of effectiveness in the design process.
Prerequisites: CVEG 3302 or CVEG 3053.

CVEG 4303 Water Resources Engineering: 3 semester hours.
Control and utilization of water; flood control; water distribution systems; open channel flows; and hydraulic structures.
Prerequisites: CVEG 3303 or CVEG 3063.

CVEG 4304 Systems Engineering: 3 semester hours.
Formulation and solution of engineering optimization problems with uncertainty factors; inclusion of sensitivity and risk analyses in optimization problems; topics in engineering management.
Prerequisites: MATH 3302 or MATH 3023 and (CVEG 3302 or CVEG 3053).

CVEG 4305 Special Topics: 3 semester hours.
Selected current and emerging topics in Civil Engineering depending on need determined by the department.

CVEG 4399 Independent Study: 1-3 semester hour.
Readings, research, and/or field work in selected topics.

CVEG 4600 Civil Engineering Internship II: 6 semester hours.
An internship program of advanced work experience with an approved engineering oriented firm, agency, or consulting firm, or engineering public service agency providing practical work experience of the profession on the job. A comprehensive written report of the work-learning experience is required.

CVEG 5300 Physical/Chemical Unit Operations in Water and Wastewater Treatment: 3 semester hours.
Physical and chemical processes used in the water and wastewater treatment and applications of these processes to other environmental media. Application of the principles of chemistry, rate processes, and process engineering to analyze and design water and wastewater treatment and other major environmental systems.

CVEG 5301 Hazardous Waste Management: 3 semester hours.
Environmental legislation, regulations concerning the identification, storage, transport, and disposal of hazardous wastes. Treatment processes; control mechanisms; landfill technology and disposal practices.

CVEG 5302 Air Pollution Engineering: 3 semester hours.
The nature of the air pollution problem and its effects on the public at large. Present legal and engineering controls to combat pollution. Techniques of air sampling and testing.

CVEG 5303 Finite Element Analysis: 3 semester hours.
Using numerical integration, Galerkin-weighted residual and variation approaches to formulate and solve one-and-two dimensional problems in solid mechanics, fluid flow, heat transfer, and electro-magnetism.

CVEG 5304 Energy and Environmental Sustainability: 3 semester hours.
Energy and the environment; energy and climate change; environmental impacts of energy production and use; concepts of sustainability in energy generation technologies of the future; energy conservation, and other development in the new energy economy.

CVEG 5305 Pretressed Concrete Design: 3 semester hours.
Principles and concepts of design in prestressed concrete including materials behavior, prestress loss, elastic and ultimate strength analyses for flexure, shear, torsion, bond and deflection.

CVEG 5306 Geospatial Information Management: 3 semester hours.
Introduction and use of geospatial information systems in engineering management. Geographic Information Systems, use of databases, geocoding, geospatial analysis in the context of a project.

CVEG 5307 Water Resources Systems: 3 semester hours.
Formulation of mathematical representations of complex water resources systems and their evaluation using linear programming, dynamic programming, non-linear programming or by the use of formal heuristics. Sample models include: optimal sewer design, optimal capacity expansion of projects, and reservoir systems planning and management.
Prerequisites: GNEG 5320 or GNEG 5302.

CVEG 5309 GEOSCIENCES and GEOSPATIAL INFORMATION: 3 semester hours.
Introduction of geosciences concepts for information management. Basic concepts in geosciences including Geographic Information Systems (GIS) and the application of geospatial analysis methods in engineering.

CVEG 5322 Design of Bridges: 3 semester hours.
Design of reinforced concrete and prestressed concrete, steel beam, continuous beam girder bridges; introduction to design of piers, abutments and bearings; bridge construction and fabrication.
Prerequisites: CVEG 5213 or CVEG 5305.

CVEG 5363 Advanced Foundation Design: 3 semester hours.
Introduction to Foundation Engineering, Subsoil Exploration techniques, Design of Shallow and Deep Foundation.

Electrical Engineering Courses

ELEG 1101 Intro Engr Computer Sci & Tech: 1 semester hour.
Introduction to basic engineering, computer science and technology concepts. Students will become aware of the various disciplines of engineering, computer science and technology, ethical and professional responsibilities in these fields, creativity and design.
Co-requisite: GNEG 1010.

ELEG 1102 Introduction to Electrical and Computer Engineering Laboratory: 1 semester hour.
An introduction to the practice of electrical and computer engineering including identifying electronic components, operating electronic test and measurement instruments. Laboratory exercises include signal generators, passive components, and electronic circuits involving diodes, operational amplifiers and sensors.

ELEG 1301 Programming for Computer Engineering I: 3 semester hours.
Fundamentals of C++ programming language. Logic of algorithms, flowcharts, program looping, conditional statements, arrays, strings, preprocessor, inputs, outputs, functions and pointers, applications and projects for Computer Engineering majors.
Prerequisites: MATH 1113 or MATH 1314 or COMP 1300 or COMP 1003.
Co-requisite: MATH 1314.

ELEG 1304 Computer Applications in Engineering: 3 semester hours.
Fundamentals of C++ Programming language and MATLAB applications software. Logic of algorithms, flowcharts, program looping, conditional statements, arrays, functions and pointers, Engineering applications and team projects.
Prerequisites: (MATH 1314 (may be taken concurrently) or MATH 1113 (may be taken concurrently)) or (MATH 1511 (may be taken concurrently) or MATH 1115 (may be taken concurrently)) or (MATH 1316 (may be taken concurrently) or MATH 1123 (may be taken concurrently)) or (MATH 2413 (may be taken concurrently) or MATH 1124 (may be taken concurrently)) or (MATH 2414 (may be taken concurrently) or MATH 2024 (may be taken concurrently)).

ELEG 1321 Programming for Computer Engineering II: 3 semester hours.
Development of advanced programming skills through review of programming concepts, and knowledge of recursion, structures, including array of structures, algorithms, object-oriented programming concepts including classes, inheritance. Coding applications and projects for Computer Engineering majors.
Prerequisites: ELEG 1301.

ELEG 2101 Electric Circuits Laboratory: 1 semester hour.
Operation of basic laboratory-type test and measurement equipment. Experimentation in basic current-voltage relations, circuit laws and network analysis of linear DC and AC circuits. Use of oscillospe in circuit analysis. RL, RC, RLC, resonance, Op-Amp circuits, and transient circuit experiments, Statistical analysis of elements of Electrical Circuits.
Prerequisites: ELEG 2305 (may be taken concurrently) or ELEG 2023 (may be taken concurrently).

ELEG 2131 Logic Circuits Lab: 1 semester hour.
Number systems and codes. Boolean algebra and logic minimization methods. Combinational and sequential design using logic gates and flip flops. Computer-aided design tools for digital design, simulation, and testing. Field Programmable Gate Array (FPGA) Devices and Verilog programming language.
Co-requisite: ELEG 2311.

ELEG 2305 Network Theory I: 3 semester hours.
Study of basic circuit laws and theorems. Study of basic circuit analysis techniques, use of controlled sources, and transient and sinusoidal circuit analysis.
Prerequisites: (PHYS 2326 or PHYS 2523) and (MATH 2320 (may be taken concurrently) or MATH 2043 (may be taken concurrently)).
Co-requisite: ELEG 2101.

ELEG 2311 Logic Circuits: 3 semester hours.
Introduction to digital systems,number systems and codes. Boolean algebra and logic gates; gate-level minimization;combinational logic; synchronous sequential logic; parallelism with Field Programmable Gate Array (FPGA) and Hardware Description Languages (DHL), such as Verilog, VHDL,or system Verilog.
Co-requisites: ELEG 2131, ELEG 2305.

ELEG 2315 Introduction to Electrical Engineering: 3 semester hours.
Introductory course for non-majors. Basic circuit theory, analysis of DC circuits; transient analysis of RLC circuits; steady state analysis; transformers; DC machines and induction motors; diode circuits; operational amplifiers; numbering systems, logic gates and combinational circuits.
Prerequisites: (MATH 2320 (may be taken concurrently) or MATH 2043 (may be taken concurrently)) and (PHYS 2326 or PHYS 2523).

ELEG 2321 Data Structure and Algorithm with Python: 3 semester hours.
Python data structure and advanced algorithm design and development. Fundamentals of Python programming, introduction on Linux system, list and sorting, sets and maps, tree, graph and heaps, engineering applications and team projects.
Prerequisites: ELEG 1301 or ELEG 1043 or ELEG 1304 and (MATH 1124 or MATH 2413).

ELEG 2331 Advanced Programming and Applications: 3 semester hours.
Advanced software development with a focus on problem solving skills. Design, implementation, and testing of several large programs in a Linux environment using current technologies. Logic of algorithms, program looping, selection statements, functions, file inputs and outputs, functions and object-oriented programming, engineering applications and projects.
Prerequisites: ELEG 1301.

ELEG 3104 Microelectronic Processing and Characterization Lab: 1 semester hour.
Basic processes of microelectronic fabrication; doping, oxidation, photolithography, etching, metallization and clean room practices. Basic materials and device characterization.
Prerequisites: ELEG 3033 or ELEG 3303 and (ELEG 2011 or ELEG 2101).

ELEG 3107 Microprocessor Systems Design Laboratory: 1 semester hour.
Use of development tools in the design and implementation of microprocessor / microcontroller based systems. Assembly language programming, parallel I/O communication interfacing, interrupts, and timers.
Prerequisites: ((ELEG 3306 or ELEG 3063) and (ELEG 1304 or ELEG 1043)) or ((COMP 1336 or COMP 1213) and (ELEG 3307 (may be taken concurrently) or ELEG 3073 (may be taken concurrently))).

ELEG 3301 Network Theory II: 3 semester hours.
Continuation of transient and sinusoidal analysis. Study of average and RMS power, poly-phase circuits, complex frequency, frequency response, and magnetic circuits.
Prerequisites: ELEG 2305 or ELEG 2023.

ELEG 3302 Signals and Systems: 3 semester hours.
Basic discrete and continuous time signals, properties of systems, linear time invariant systems, Fourier analysis, z-transformers, LaPlace Transform.
Prerequisites: ELEG 3301 or ELEG 3013.

ELEG 3303 Physical Principles of Solid State Devices: 3 semester hours.
Crystal structure, introduction to quantum concepts and discrete energy levels; atomic bonding, soli-state band theory, Fermi-Dirac statistics, charge carrier transport, and introduction to semiconductor device physics and operation.
Prerequisites: (CHEM 1403 or CHEM 1034) or (CHEM 1043 or CHEM 1304) and (MATH 2320 or MATH 2043) and (PHYS 2326 or PHYS 2523).

ELEG 3304 Electronics I: 3 semester hours.
Operational amplifiers. Diodes and nonlinear circuits. Field effect transistors. Analysis and design of linear amplifiers. Biasing, small and large signal behavior. Operation of bipolar junction transistors.
Prerequisites: (ELEG 3303 or ELEG 3033) and (ELEG 3301 or ELEG 3013).

ELEG 3307 Microprocessor System Design: 3 semester hours.
Introduction to architecture, operation, and application of microprocessors; microprocessor programming; address decoding; system timing; parallel, serial, and analog 110; interrupts and direct memory access; interfacing to static and dynamic RAM; microcontrollers. Introduction to Microcomputers.
Prerequisites: (ELEG 3306 or ELEG 3063) and ((ELEG 1304 or ELEG 1043) or (COMP 1213 or COMP 1336)).
Co-requisite: ELEG 3107.

ELEG 3615 Engineering Internship I: 6 semester hours.
An internship program or work experience with an approved engineering firm or engineering oriented business agency, planning, public service agency, or consulting firm, providing an introduction to the profession.

ELEG 4100 Communications Lab: 1 semester hour.
Laboratory practice of communications theory, AM and FM modulation, transmission and reception. Analysis of signals and effect of noise interference on communications
Prerequisites: ELEG 4300 (may be taken concurrently) or ELEG 4003.

ELEG 4101 Electronics Laboratory: 1 semester hour.
Applications of semiconductors diodes. Operational characteristics of transistor amplifiers (inverters, emitter follower, difference, etc.) FET characteristics and applications. Operational amplifier characteristics and circuit implementation. Frequency response of amplifiers.
Prerequisites: (ELEG 2101 or ELEG 2011) and (ELEG 3304 (may be taken concurrently) or ELEG 3043 (may be taken concurrently)).

ELEG 4102 Power Laboratory: 1 semester hour.
Operational characteristics of DC and AC machines; Transformers; power circuit analysis, DC to DC converters, Inverters; DSP-Based Electric Drive Systems.
Prerequisites: ELEG 4301 or ELEG 4013.

ELEG 4131 Advanced Logic Design Laboratory: 1 semester hour.
Design and laboratory implementation of digital systems using standard, integrated circuits.
Prerequisites: ELEG 4335 (may be taken concurrently) or ELEG 4355 (may be taken concurrently).

ELEG 4247 Senior Design and Professionalism I: 2 semester hours.
This is the first course of a two-semester capstone experience (ELEG 4248 must immediately follow ELEG 4247 or sequence must restart with 4247) involving engineering design of an industrial or advanced team project. Elements of ethics and professionalism in engineering practice are integrated into the project experience. The project will include application of relevant engineering codes and standards, as well as realistic constraints. Design achievements are demonstrated with written reports, and oral presentation, and professional standards and ethics examinations.
Prerequisites: (CHEG 2308 or CHEG 2003) and (ELEG 3306 or ELEG 3063) and (ELEG 3304 or ELEG 3043).

ELEG 4248 Senior Design and Professionalism II: 2 semester hours.
A continuation of ELEG 4472 with required design modifications of the team projects necessary to produce a working prototype of the designs initiated in Senior Design and Professionalism I. Results of the design are presented in a Design project deliverables including an oral presentation, a written report, and a formal, final oral presentation, as well as a final report. Professionalism education with demonstration of prototype, or a model of the design. Elements of professionalism reinforce the importance of professional engineering ethics, corporate culture, life-long learning, and globalization.
Prerequisites: ELEG 4472 or ELEG 4247.

ELEG 4300 Communication Theory: 3 semester hours.
Signals and spectra. Transmission and processing of signals. continuous-wave modulation and pulse modulation. Baseband pulse transmission and pass-band digital transmission. Signal space analysis. Information measures.
Prerequisites: (ELEG 3302 or ELEG 3023) and (MATH 3302 or MATH 3023).

ELEG 4301 Electromechanical Energy Conversion: 3 semester hours.
Electric and magnetic devices, force and torque measurements, iron core transformers, single phase and poly-phase power circuit analysis. Introduction to per unit system.
Prerequisites: (ELEG 3301 or ELEG 3013) and (MATH 4317 or MATH 4173).

ELEG 4302 Power Systems Engineering: 3 semester hours.
Elementary synchronous machines. General considerations of power generation, transmission, distribution and utilization, survey of load flow, faults, transient stability and economic power dispatch.
Prerequisites: ELEG 4013 or ELEG 4301.

ELEG 4304 Electronics II: 3 semester hours.
Design and analysis of single and multistage transistor amplifiers, difference amplifiers, frequency response of amplifiers. Feedback concepts. Analysis and design using discrete and integrated devices.
Prerequisites: ELEG 3304 or ELEG 3043.

ELEG 4305 Electromagnetic Field Theory I: 3 semester hours.
Review of relevant mathematics, electricity, and magnetism. Study of dielectrics, Poisson's and LaPlace's equations, magnetic flux, magnetic fields, and magnetic boundary conditions, Ampere's Circuital law, time varying fields and Maxwell's equations.
Prerequisites: (ELEG 2305 or ELEG 2023) and (MATH 4317 or MATH 4173).

ELEG 4307 Servomechanism and Control Systems: 3 semester hours.
Model of physical systems, system responses, system characteristics, stability design, frequency response analysis and design, discrete -time systems.
Prerequisites: ELEG 3023 or ELEG 3302 and (MATH 4173 or MATH 4317).

ELEG 4310 Special Topics: 3 semester hours.
Selected current and emerging topics in Electrical Engineering. Courses may be repeated for credit when topics vary.

ELEG 4313 Broadband Communication Systems I: 3 semester hours.
Introduction of various areas of high-speed communication systems. The basic ideas of DSL technology. Telephone subscriber loop environment. Twisted-Pair channel modeling. Transceiver front-end noise models. Channel capacity testing and analysis techniques of xDSL systems. Students will be expected to research and present various topics of interests in class. Projects are expected from the students at the end of the semester. Other special topics of interest will be covered especially as they relate to xDSL issues.
Prerequisites: ELEG 3023 or ELEG 3302.

ELEG 4322 Electronic and Photonic Materials and Devices: 3 semester hours.
Properties of insulators, conductors, semiconductors, electro-optical and magnetic materials. Basic operation of opto-electronic devices and systems.
Prerequisites: ELEG 3033 or ELEG 3303.

ELEG 4323 Broadband Communication Systems II: 3 semester hours.
Topics include Hybrid Circuits, Analog Front end precision issues, channel equalization, Echo cancellation, Error Correction and Trellis Coding. Varieties of Digital Subscriber Line (XDSL), testing issues relating to XDSLs. Standards and standard related issues with emphasis on Asymmetric Digital Subscriber Line.
Prerequisites: ELEG 4313.

ELEG 4324 Power Electronics: 3 semester hours.
Characteristics of solid state power switches, controlled rectifiers and inverters; DC choppers; AC power controllers; applications to power supplies, electric machine drives, HVDC power transmission and space power systems.
Prerequisites: ELEG 3043 or ELEG 3304 and (ELEG 4013 or ELEG 4301).

ELEG 4325 Computer Interfacing and Communications: 3 semester hours.
Introduce software design and hardware interfacing of embedded systems, microcontroller based parallel and serial communications, I/O programming, low power computing, data acquisition and communication, emphasis on student projects.
Prerequisites: (ELEG 3107 or ELEG 3071) and (ELEG 3307 or ELEG 3073).

ELEG 4326 VLSI Circuit Design: 3 semester hours.
Analysis and design of monolithic integrated circuits, device modeling; CAD tools and computer-aided design, design methodologies of VLSI circuits
Prerequisites: ELEG 3043 or ELEG 3304 (may be taken concurrently) and (ELEG 3063 or ELEG 3306 (may be taken concurrently)) and (ELEG 4043 or ELEG 4304 (may be taken concurrently)).

ELEG 4330 Introduction to Digital Design: 3 semester hours.
The use of hardware description language and automated synthesis in design. hierarchical and modular design of digital systems. Control logic, synchronous and asynchronous sequential circuit design. Programmable logic devices and field programmable gate arrays. Circuit simulation for design verification and analysis. Timing-oriented design.
Prerequisites: (ELEG 3306 or ELEG 3063) and (ELEG 3307 or ELEG 3073).

ELEG 4333 Communication Network Engineering: 3 semester hours.
Multi-service applications: Voice/IP, Video on-demand and Video Conferencing. Physical layer design issues including the modulation, demodulation, synchronization, bandwidth, SNR, and interfaces. Link layer design including medium access control, error detection and retransmission strategies. Network routing strategies and transport layer functionality. Design of wired and wireless Local Area Networks based on IEEE 802.x standards. Design of INTERNET Architectures configured with network routing, and the use of network components such as routers, switches and hubs.
Prerequisites: ELEG 4303 or ELEG 4330.

ELEG 4335 Advanced Logic Design: 3 semester hours.
Introduction to the design, modeling and verification of complex digital system, modem design, methodologies for logic design, development of tools for the design and testing of digital systems.
Prerequisites: ELEG 3073 or ELEG 3307.
Co-requisite: ELEG 4131.

ELEG 4336 Introduction to High Performance Computing: 3 semester hours.
The course will introduce high performance computing hardware architecture, software tools, and applications.
Prerequisites: ELEG 3307 or ELEG 3073.

ELEG 4339 Computer Organization and Design: 3 semester hours.
An introduction to computer organization using assembly and machin language. Number representation, computer arithmetic, instruction sets, I/O interrupts, and programming interrupts. Projects involve detailed study and use of a specific computer hardware and software system, VLSI design project.
Prerequisites: ELEG 3063 or ELEG 2311.

ELEG 4361 Design of Digital System Applications Using Field Programmable Gate Array Devices: 3 semester hours.
Three credit hours; This course provides instruction and application into the use of Hardware Descriptive Language in program development using gate level modelling, data flow modelling, behavioral modelling, top down and bottom up design using combinational logic and state machine design; software simulation and design implementation and testing using FPGAs.
Prerequisites: ELEG 3063 or ELEG 3306.

ELEG 4371 Foundation and Application of Internet of Things: 3 semester hours.
The course will give a systematic introduction to IoT technology, and the popular hardware platform such as Raspberry Pi together with some sensor kits will be adopted. It will cover the basic concepts and fundamental principles of IoT, including (i) IoT devices/things and its design, (ii) Embedded sensing and processing, (iii) Low power IoT networking and communication, and (iv) Computing and Data Analytics. A project-based teaching and learning approach will be adopted.
Prerequisites: ELEG 2331.

ELEG 4372 Computer and Network Security: 3 semester hours.
This course introduces students to the basic network Cybersecurity Principles Overview of Computer Security; Computer Networks and Internet Overview; IT System Components Network Technology and Protocols; Network Defense; Network TCP/IP Stack and Attacks; Attacks on Industrial Control Systems; Firewall, and Intrusion Detection and Prevention System; Key Distribution and User Authentication Transport-Level Security; IP Security; Short Introduction to cryptography
Prerequisites: ELEG 3023 or ELEG 3302.

ELEG 4373 Cyber Physical Systems: 3 semester hours.
Students gain an understanding across the breadth of cybersecurity including system monitoring, networking basics and penetration testing. An applied approach to statistics is also included to prepare students to assess the data collected for their research projects. The course is conducted with a hands-on approach applying virtual environments to practice the concepts learned in the technical lectures each week.
Prerequisites: ELEG 3023 or ELEG 3302.

ELEG 4374 Introduction to Cryptography: 3 semester hours.
This course provides an introduction to modern cryptography and communication security. It focuses on how cryptographic algorithms and protocols work and how to use them. The course covers the concepts of block ciphers and message authentication codes, public key encryption, digital signatures, and key establishment, as well as common examples and uses of such schemes, including the AES, RSA-OAEP, and the Digital Signature Algorithm. Basic cryptanalytic techniques and examples of practical security solutions are explored to understand how to design and evaluate modern security solutions.
Prerequisites: ELEG 3023 or ELEG 3302.

ELEG 4377 Machine Learning for Engineering Applications: 3 semester hours.
Machine Learning for Engineering Applications. Credit 3 semester hours. Fundamentals of machine learning model and its design and implementation. Data preprocessing, feature engineering, various classifiers and regression, clustering, engineering applications and team projects.
Prerequisites: ELEG 2331.

ELEG 4378 Mobile Edge Computing: 3 semester hours.
The course will provide a systematic introduction to mobile edge computing. It will cover the architecture of mobile edge computing with its entities and protocols, from the edge devices via middle layers up to the cloud. It will also cover the computing and communication technologies used in mobile edge computing, as well as their performance, power efficiency, storage, and communication bandwidth constraints. The edge data analytics and the security and privacy issues of mobile edge computing will also be discussed.
Prerequisites: ELEG 2331.

ELEG 4399 Independent Study: 1-3 semester hour.
Readings, research, and/or field work on selected topics.

ELEG 4615 Engineering Internship II: 6 semester hours.
An internship program or work experience with an approved engineering firm or engineering oriented business agency, planning agency, public service agency, or consulting firm which provides an introduction to the profession.

ELEG 5391 Engineering Project: 3 semester hours.
An engineering design and analysis investigation at the master's level. Topic to be decided between student and advisor and should be relevant to students specialty area. A written project report is required to be presented, defended orally and submitted to the faculty advisory committee for approval.

ELEG 5396 Electrical Engineering Research: 3 semester hours.
Methods and practice of Electrical Engineering research performed under the supervision of graduate advisor.

ELEG 5696 Research: 6 semester hours.
Engineering research under the supervision of graduate advisor.

ELEG 5699 Thesis: 6 semester hours.
A candidate for the Master of Science in Electrical Engineering is required to perform a study, a design of investigation, under the direction of a faculty advisory committee. A written thesis is required to be presented, defended orally and submitted to the faculty advisory committee for approval.

ELEG 6101 Graduate Seminar I: 1 semester hour.
Seminar on emerging areas of electrical engineering. Research presentations by faculty, students and invited guests.

ELEG 6102 Graduate Seminar II: 1 semester hour.
Continuation of ELEG 6011.

ELEG 6310 Advanced Computer Systems Design: 3 semester hours.
Digital Design Methodologies, System Design CAD tools, Hardware Description Language, Simulation, Verification and Synthesis.
Prerequisites: ELEG 4303 or ELEG 4330.

ELEG 6311 Computer Architecture & Advanced Logic Design: 3 semester hours.
Overview of switching theory, logic design, combinatorial and sequential circuits, and FSMs. Computer architecture: organization and design with CPU, Memory, cache, VO, OS, DMA, MMU, operations of interrupt and. DMA, and performance analysis. Special architectures: Parallel architectures, microprogramming, RISC, and ASIC design overview.
Prerequisites: ELEG 4330 or ELEG 4303.

ELEG 6312 The Internet: Design and Implementation: 3 semester hours.
Overview of ISO Reference Model. Homogeneous, heterogeneous and ad-hoc network architectures. Reference Model of end-to-end networking: access networks, enterprise networks and core networks, internetworking issues and protocol architecture. Internet network elements and protocols including routers, switches, diffServe, MPLS, and VPN. Internet applications and Quality of Service issues.

ELEG 6314 Fault Tolerant Computing: 3 semester hours.
Key concepts in fault-tolerant computing. Understanding and use of modern fault-tolerant hardware and software design practices. Case studies.
Prerequisites: ELEG 4339.

ELEG 6315 Information Networks: 3 semester hours.
OSI Reference model overview, concept of peer-to-peer operation, and layer functions. Circuit switched networks, packet switched networks, ATM and FR networks. Access networks: LANs, DSL, T1/E1, and wireless. Enterprise and core networks: Protocol architectures such as TCP, UDP, IP, ATM, VPN, and MPLS. Interconnecting the networks for end-to-end operation for connectionless and connection oriented protocols. Modeling and performance analysis of network protocols. Signaling and network management overview.

ELEG 6316 Statistical Learning for Big Data: 3 semester hours.
This course focuses on principles and best practices of machine learning from a probabilistic perspective with a strong tilt towards applications in big data analytics. It will cover various aspects of statistical learning theory, theory of generalization, overfitting and regularization, validation and cross-validation. It will also cover linear classifiers, linear regression, logistic regression and nonlinear transformations, neural networks and support vector machines.

ELEG 6318 Deep Learning: 3 semester hours.
This course focuses on the underlying theory, the range of applications to which deep learning has been applied, and learning from very large data sets. Topics include deep feed-forward networks, optimization for training deep models, convolutional and recurrent neural networks, structured probabilistics models, autoencoders, and Monte Carlo methods. The course will also train students to use open-source software such as TensorFlow to gain hands-on experiences.

ELEG 6320 Wireless Networks: 3 semester hours.
Overview of mobile and cellular networks, I, II, III and IV generation systems. Mobile computing systems, and architecture and design of digital cellular wireless networks. Design of IEEE 802 Wireless LANs and standards. Performance considerations for user and node mobility management. Power and propagation, dynamic routing and re-configurable networks. Mobile transport protocols including IP, ATM, and TCP. Middleware considerations. Mobile applications, management and service provisioning.

ELEG 6321 Digital Communication: 3 semester hours.
Overview of Digital Communications fundamentals of AM, FM and PM. Concept of Nyquist criteria, SNR, Wave shaping, Shannon's theory. Digital waveform coding methods. Channel impairments: random noise, cross talk, inter-modulation, information recovery process. Design of modems and SNR improvements by noise shaping and canceling techniques. Integrated Services Digital Networks: Channelization, clock recovery, framing and recovery of information, end-to-end connectivity methods, signaling and management operations.

ELEG 6322 Coding Theory: 3 semester hours.
Linear codes: parity and generator matrices, syndrome error correction and detection capability, minimum distance. Performance bounds of linear codes, Hamming and Golay codes, Galois fields, shift-register implementation. Cyclic codes. BCH codes: the BCH decoding algorithm, burst-correction codes.
Prerequisites: ELEG 4300 and ELEG 6331.

ELEG 6324 Advanced Broadband Communications Systems: 3 semester hours.
Overview: Definition of Broadband, broadband architectures: DSL, DSLAM and variations, Digital wireless, and introduction to packet and circuit switching technologies. Standards of DSL. Design of HDSL, ADSL, XDSL systems and methods to improve bandwidth enhancements on TTP. Design of high-speed operation: Impact on existing TIP (Cat3, 5), digital wireless, CATV and satellite network architectures. Modeling and Performance analysis of different broadband systems for data and multi-service environment. Transmission impairments and information recovery process: noise shaping, signal shaping, and Impact of cross-talk, inter-modulation in the physical medium.
Prerequisites: ELEG 4313.

ELEG 6325 Telecommunications Network Security: 3 semester hours.
Overview of cryptography. Public and private key encryption. Privacy, authentication, authorization and digital signatures, and Hash algorithms. Design of network security using private key encryption (DES) and public key encryption (RSA). Concept of electronic codebook and knowledge proof systems. Intrusion detection and active prevention and firewalls. Scrambling techniques for non-data signals such as voice and video. Security management design for networks.
Prerequisites: ELEG 6331.

ELEG 6330 Signal Detection and Estimation: 3 semester hours.
Statistical detection theory; signal and parameter estimation theory; likelihood-ratio decision rules; Bayesian probability, maximum-likelihood, maximum-a-posterior, Neyman-Pearson, and minimum-error criteria; Cramer-Rao Bound; unbiased estimators; Kalman and Wiener filters, estimators; simple and composite hypothesis testing, optimum linear filtering, smoothing and prediction, nonlinear estimation.
Prerequisites: ELEG 6313.

ELEG 6331 Stochastic Processes: 3 semester hours.
Probability overview, distribution and density functions, moments, time averaging and sampled averaging. Stochastic processes: Gaussian, Markov process, Poisson, Rice, Wiener-Levy processes, bi-model and tri-model processes. Modeling of systems using stochastic processes and system analysis. Karhunen-Loeve transform, bounds and their use in systems. Decision Rules: Maximum likelihood, Minimum Error, Kalman and Wiener filters, Linear and non-linear estimation and Optimization techniques.
Prerequisites: MATH 3302 or MATH 3023.

ELEG 6333 Wavelets and Their Applications: 3 semester hours.
Time-frequency analysis. Continuous, discrete, and discrete-time wavelet transform. Multi-rate filter banks. Multi-band wavelets, two-dimensional wavelets. Wavelet packets and matching pursuit. Wavelets in noise filtering, compression, modeling of fractals, communications, detection, adaptive systems, neural networks, and fast computation.
Prerequisites: ELEG 4003 or ELEG 4300.

ELEG 6342 VLSI and ULSI Design: 3 semester hours.
MOS transistor and characteristics, CMOS inverter and transmission gates. Design of complex CMOS gates; combinational and sequential design techniques in VLSI and ULSI; issues in static transmission gate and dynamic logic design; CMOS technology and layout design rules. Use of CAD tools to layout, check and simulate circuits. Design, layout and simulation of a small project.

ELEG 6350 Advanced Photonics Materials and Devices: 3 semester hours.
Optical properties and processes in elemental and compound semiconductors; junction theory of homo- and hetero-junctions; theory and operation of various opto-electronic devices including light emitting diodes, laser diodes, photo detectors and solar cells; Opto-electronic modulation and switching; light transmission and integrated applications.

ELEG 6351 Advanced Quantum Devices: 3 semester hours.
Selected topics in advanced concepts in quantum theory of semiconductors including transport theory; qualitative description of superconductivity and related devices, description and analysis of quantum and Nano-scale devices such as RTDs, Nano-tube transistors, SETs and molecular electronics, description of device fabrication techniques such as epitaxial growth, characterization of hetero-structures, quantum wells and super lattices including strained layers.

ELEG 6352 Advanced Characterization of Materials and Devices: 3 semester hours.
The theory and application of state-of-the-art characterization techniques on advanced materials and devices; experimental techniques that describe the electronic, structural and thermal properties of materials. Emphasis will be placed on materials and devices that are current areas of research and development.

ELEG 6354 Advanced Solid State: 3 semester hours.
This course will be a survey of selected topics in areas of solid state devices that are in the research and development stage. Topics will include new material systems, new methods for fabrication and processing microelectronics, new device structures and architectures for integrated circuits, new methods for large-scale integration of the next generation devices.

ELEG 6360 Modern Artificial Intellegence: 3 semester hours.
This course focuses on fundamental principles and techniques of modern Artificial Intelligence (AI). It will cover the underlying theory, and the range of applications to which AI has been applied. Specifically, search and game playing, graphical models, Markov Decision Processes, and reinforcement learning. The course will also train students to use open-source AI software to gain hands-on experiences.

ELEG 6361 Advanced Artificial Intelligence: 3 semester hours.
This course will cover advanced topics and applications in AI such as sentiment analysis, machine translation, knowledge graph, and face recognition. Furthermore, this course will introduce complicated AI systems such as Question Answer System and Object Tracking System. The course will also train students to use open-source AI software to gain hands-on experiences.
Prerequisites: ELEG 6603 or ELEG 6360.

ELEG 6365 Intro to High Perf Computing: 3 semester hours.
Three credit hour lecture for graduate students. The course will introduce high performance computing hardware architecture and software tools. It will provide an opportunity for students to build and execute sample parallel codes for scientific research.

ELEG 6370 Selected Topics in Deep Learning: 3 semester hours.
This course will cover advanced topics in deep learning, such as Deep Transfer Learning, Generative Adversarial Nets, Deep Reinforcement Learning, and Adversarial Machine Learning. In addition, it will cover important use cases of various deep learning models. The course will also train students programming skills with Python and open-source deep learning software such as TensorFlow to gain hands-on experiences.
Prerequisites: ELEG 6183 or ELEG 6318.

ELEG 6371 Power System Faults Protective: 3 semester hours.
Calculation of power system currents and voltages during faults; protective relaying principles, application and response to system faults. Characteristics of protection components. Prerequisite: approval of instructor. This course is repeatable up to 6 semester hours.

ELEG 6372 Power System Stability: 3 semester hours.
Modeling of the transmission system, loads, generators, excites, and governors; prefault and postfault conditions; effect of system protection schemes on stability computational aspects of load-flow solutions; system security considerations. Writing programs for state-by-state analysis and Monte Carlo power system analysis. Steady-state, dynamic and transient stability of power systems; solution techniques; effect of generator control systems.

ELEG 6373 High Voltage Direct Current: 3 semester hours.
Overview of HVDC systems; comparisons of AC and DC power transmission; study of six-pulse and twelve-pulse power converters; analysis and control of HVDC systems; harmonics and power factor effects; systems faults and mis-operations; state of the art and future developments in HVDC technology; inspection trips.

ELEG 6374 Power Gen Oper Control: 3 semester hours.
Engineering aspects of power system operation. Economic analysis of generation plants and scheduling to minimize total cost of operation. Scheduling of hydro resources and thermal plants with limited fuel supplies. Loss analysis, secure operation. Power System Modeling. Power System organizations.

ELEG 6375 Advanced Power System: 3 semester hours.
Economic Dispatch. Solving sets of equations that involve large sparse matrices. Sparse matrix storage, ordering schemes, application to power flow analysis, short circuit calculation, power system planning and operation.

ELEG 6376 Power Electronics Power System: 3 semester hours.
Impact of power electronics loads on power quality. Passive and active filters. Active input current wave shaping. HVDC transmission. Static VAR control, energy storage systems. Interconnecting photovoltaic and wind generators. Static phase shifters and circuit breakers for flexible AC transmission.

ELEG 6377 Advanced Electric Drives: 3 semester hours.
D-q axis analysis of salient-pole synchronous motor drives. Vector-controlled induction motor drives, sensor-less drives, voltage space-vector modulation techniques, current-source inverter drives, reluctance drives. Power quality issues. Integrated software lab.

ELEG 6378 Advanced Power Electronics: 3 semester hours.
Physics of solid-state power devices, passive components, magnetic optimization, advanced topologies. Unity power factor correction circuits, EMI issues, snubbers, soft switching in dc/ac converters. Very low voltage output converters. Integrated computer simulations.

ELEG 6380 Introduction to Bioinformatics: 3 semester hours.
This course introduces Bioinformatics and provides a wide range of both fundamental and practical topics, focusing on application of computational and engineering skills in biology and medicine, including: brief introduction to biology and genomics, engineering statistics, data science, and bioinformatics. The course will require students to participate in a research project related to bioinformatics.

ELEG 6381 Advanced Bioinformatics: 3 semester hours.
This course teaches advanced topics in Bioinformatics including analysis of large scale genomic data and associated annotation data. In addition, strong emphasis is given to the interpretation and presentation of analytic outcomes. Research project analyzing large scale genomic data is required to complete the course.
Prerequisites: ELEG 6380.

ELEG 6382 Computational Systems Biology: 3 semester hours.
Computational Systems Biology is an emerging field of research which requires multidisciplinary training in engineering and biology. This course introduces the students into the realm of physics conceptualization of biological system and teach them how to develop and use mathematical models and computer simulation to understand the network design rules.
Prerequisites: ELEG 6380.

ELEG 6383 Computational Modeling of Biological Systems: 3 semester hours.
This course introduces the emerging field of systems biology and promotes application of Electrical and Computer Engineering methodology in biomedical fields. It covers many aspects of biomathematical modeling, including: the choice of a modeling framework; the design of interaction diagrams; the identification of variables and processes; standard methods of parameter estimation; the analysis of steady states, stability, and sensitivity; and the simulation of representative biomedical scenarios.
Prerequisites: ELEG 6380.

ELEG 6385 Fundamentals of Power Electronics and Motor Drives: 3 semester hours.
Power Electronics and Motor Drive: Control of electrical energy using solid state devices, diodes, thyristors, and triacs; Chopper Circuits, mathematical analysis of circuits containing these devices; power converters and control; solid-state drives for motor control.

ELEG 6386 Renewable Energy Sources: 3 semester hours.
Solar thermal energy and photovoltaics; bioenergy, hydroelectricity, tidal power, wind, wave and geothermal energies; integration of renewable energy systems.

ELEG 6387 Smart Grid: Fundamentals of Design and Analysis: 3 semester hours.
Evolution of the electric power grid; basics of electric power systems; transmission networks; solar and wind power generation; integration of variable energy resources; impact of distributed generation and electric vehicles, macro and micro grids; and data communications standards for the grid.

ELEG 6391 Special Topics in Elec Engr: 3 semester hours.
Special topics in electrical engineering relating electrical energy, digital systems, communications, sign processing, and nanoelectronics are selected and discussed in detail. May be repeated for credit if topics vary.

ELEG 7310 Advanced Topics in Computer Engineering: 3 semester hours.
Current research issues in computer architecture, digital design, networked-computing, embedded and real-time systems. May be repeated for credit when the topics vary.

ELEG 7601 Doctoral Research I: 6 semester hours.
Research for thesis or dissertation. Limited to doctoral students. May be repeated for credit.

ELEG 7602 Doctoral Research II: 6 semester hours.
Continuation of ELEG 7601. Limited to doctoral students. May be repeated for credit.

ELEG 7691 Doctoral Dissertation I: 6 semester hours.
The continuation of ELEG 7601 and ELEG 7602 for writing thesis. Limited to students who have been admitted to candidacy for the doctoral degree. May be repeated for credit.

ELEG 7692 Doctoral Dissertation II: 6 semester hours.
Continuation of ELEG 7691. Limited to students who have been admitted to candidacy for the doctoral degree. May be repeated for credit.

General Engineering Courses

GNEG 1010 Engineering Professionalism and Career Development: 0 semester hours.
This course prepares students for the professional engineering world. Provides career planning tools; discusses expected behaviors and soft (power) skills essential for engineering career success. The connection between personal, professional, and financial goals and how such goals contribute to short- and long-term personal, professional, academic, and financial goals. Professional, ethical, and moral behavior and proper communication for the workplace. This course enables engineers to take full advantage of internships, co-ops, engineering jobs, and the classroom.
Co-requisites: CHEG 1101, COMP 1101, CVEG 1101, ELEG 1101, MCEG 1101.

GNEG 1112 Engineering Lab II for Mathematics: 1 semester hour.
Practical applications of the 1st level Calculus for problems in engineering, computer science, and technology. The 1st level Calculus concepts will be reinforced through hands-on, physical application in the laboratory.
Co-requisite: MATH 2413.

GNEG 1319 Special Topics: 1-3 semester hour.
This special topics course enables students at all levels of matriculation to be exposed to interdisciplinary subject matter along the breadth of the field of engineering that is not taught in other courses in the general engineering or departmental curriculum.

GNEG 2102 Engr Lab III for Math: 1 semester hour.
Practical applications of the 2nd level Calculus for problems in engineering, computer science, and technology. The 2nd level Calculus concepts will be reinforced through hands-on, physical application in the laboratory.

GNEG 2115 Engineering Research I: 1 semester hour.
Research methodology course, the content of which includes an introduction to scientific method, formulation of research question, development and implementation of research plan, analysis and evaluation of results, and reporting of findings.

GNEG 2319 Special Topics: 1-3 semester hour.
This special topics course enables students at all levels of matriculation to be exposed to interdisciplinary subject matter along the breadth of the field of engineering that is not taught in other courses in the general engineering or departmental curriculum.

GNEG 2615 Engineering Cooperative Education I: 6 semester hours.
A cooperative program of engineering with an approved engineering-based industry, engineering consulting firm, or governmental regulatory agency engaged in planning and administration of engineering functions. The student receives related engineering assignments in a real work situation. The assignment is commensurate with the theoretical engineering experience of the student.

GNEG 3106 Introduction to Engineering Project Management: 1 semester hour.
Principles and techniques of managing engineering and software projects. Topics include project initiation, estimating, resource allocation, developing work plans, scheduling, progress tracking, design coordination, production coordination, quality management, managing teams and close out, and case study of real world projects.
Prerequisites: CHEG 2308 or CHEG 2003.

GNEG 3115 Engineering Research II: 1 semester hour.
This is a course of research activities consisting of library, laboratory, or other research activities on selected problems. Results of the research are presented in formal, oral, and written presentations.
Prerequisites: GNEG 2151 or GNEG 2115.

GNEG 3319 Special Topics: 1-3 semester hour.
This special topics course enables students at all levels of matriculation to be exposed to interdisciplinary subject matter along the breadth of the field of engineering that is not taught in other courses in the general engineering or departmental curriculum.

GNEG 3615 Engineering Cooperative Education II: 6 semester hours.
A cooperative program of engineering with an approved engineering-based industry, engineering consulting firm, or governmental regulatory agency engaged in planning and administration of engineering functions. The student receives related engineering assignments in a real work situation. The assignment is commensurate with the theoretical engineering experience of the student.

GNEG 4319 Special Topics: 1-3 semester hour.
This special topics course enables students at all levels of matriculation to be exposed to interdisciplinary subject matter along the breadth of the field of engineering that is not taught in other courses in the general engineering or departmental curriculum.

GNEG 4350 Cybersecurity and Public Policy: 3 semester hours.
This course examines existing and evolving cybersecurity and data protection frameworks, while exploring the complex legal, policy, and compliance challenges raised by protection efforts. Topics to be covered will include: Threats to cybersecurity, Domestic and international Internet governance, The Computer Fraud and Abuse Act, and U.S. and Texas state privacy law and personal data protection measures. Other topics may include (cyber) War, international terrorism, and U.S. surveillance law, Private information infrastructure and the law of emergencies. By the end of the course, students should have proficient understand of the rapid development of technology and security at the nexus of law, policy, compliance, and enforcement.

GNEG 4352 Advanced Fundamentals of Cybersecurity: 3 semester hours.
This course is designed to expose students to fundamentals of cybersecurity with knowledge/skills specific to (but not limited): Security assessment role in ensuring organization security, the rules of business ethics as it pertains to hacking, introduction to various tools and techniques for penetration testing, including social and ethical corporate cybersecurity responsibility.

GNEG 5189 Research: 1 semester hour.
Methods and practice in research.

GNEG 5302 Operations Research: 3 semester hours.
An introduction to quantitative modeling and optimization; linear and dynamic programming; queueing theory; inventory modeling; critical path systems; network flow modeling and technological forecasting.

GNEG 5304 Engineering Probability and Statistics: 3 semester hours.
Theory of permutations, combinations; statistical principles of analysis of random data probability as a basis of engineering design.

GNEG 5306 Engineering Analysis I: 3 semester hours.
Introduction to multi-variable calculus. Application of mathematical techniques to various engineering disciplines using linear partial differential equations-boundary value and initial value problems; Linear Optimization techniques.

GNEG 5307 Engineering Analysis II: 3 semester hours.
Complex variable theory using techniques such as conformal mapping, optimization and boundary value analysis, in engineering applications such as control systems and signal processing. Introduction to fractals (fractional dimensions) and their applications in geography and animation will be discussed.
Prerequisites: GNEG 5306 or GNEG 5063.

GNEG 5313 Engineering Numerical Methods: 3 semester hours.
Numerical methods in engineering include fundamental numerical techniques involving recursion relationships, numerical quadratures, etc., applied to engineering problems. Emphasis will be placed on the solution of advanced engineering problems involving ordinary and particle differential equations. Proven and efficient finite methods will be covered with emphasis on engineering conceptualization and formulation. An introduction to finite elements analysis.

GNEG 5315 Data Ethics: 3 semester hours.
This course will introduce, discuss, and analyze ethical issues, algorithmic challenges, and policy decisions in data science. Specifically, the moral, social, and ethical ramifications of the choices will be explored at the different stages of the data analysis pipeline. Through class discussions, case studies and exercises, students will learn the fundamentals of ethical thinking in data science, understand the history of ethical dilemmas in scientific work, and study the distinct challenges associated with ethics in modern data science.

GNEG 5319 Special Topics: 3 semester hours.
Special topics in engineering relating to materials, renewable and non-renewable resources, environmental and energy fields are selected and discussed in detail. Considers all aspects of planning, design fabrication, development and implementation.

GNEG 5320 Graduate Internship: 3 semester hours.
A realistic experience in engineering to enhance the student's professional abilities. Students work on significant projects with industry firms or governmental agencies involving decision-making responsibility. Course requires oral and written report.

GNEG 5329 Special Topics: 1-3 semester hour.
This special topics course enables students at all levels of matriculation to be exposed to interdisciplinary subject matter along the breadth of the field of engineering that is not taught in other courses in the general engineering or departmental curriculum.

GNEG 5330 Graduate Project: 3 semester hours.
A study, design, or investigation, under the direction of a graduate faculty advisor. An oral presentation and a written report are required. Prerequisite: candidacy for the Non- Thesis-Option of the Master of Science in Engineering degree.

GNEG 5389 Research: 3 semester hours.
Methods and practice in research.

GNEG 5399 Independent Study: 1-3 semester hour.
Readings, research and/or field work on selected topics.

GNEG 5608 Thesis: 6 semester hours.
A candidate for the Master Science in Engineering is required to perform a study, design or investigation, under the direction of a faculty advisory committee. A written thesis is required to be presented, defended orally and submitted to the faculty advisory committee for approval.

GNEG 5689 Research: 6 semester hours.
Methods and practice in research.

GNEG 6329 Special Topics: 1-3 semester hour.
This special topics course enables students at all levels of matriculation to be exposed to interdisciplinary subject matter along the breadth of the field of engineering that is not taught in other courses in the general engineering or departmental curriculum.

Mechanical Engineering Courses

MCEG 1101 Intro Engr Cs Tech: 1 semester hour.
Introduction to basic engineering, computer science and technology concepts. Students will become aware of the various disciplines of engineering, computer science and technology, ethical responsibilities in these fields, creativity and design.
Co-requisites: GNEG 1010, MCEG 1102.

MCEG 1102 Introduction to Mechanical Engineering Drawing and Design Lab I: 1 semester hour.
Introduction to 3D modeling, technical sketching, multi-views and visualization, geometric dimensioning and tolerancing, and working drawings and assembly.

MCEG 2301 Thermodynamics I: 3 semester hours.
First Law, transformation of energy, theoretical limitations, Second Law, absolute temperature, entropy, and available energy, properties of gases, liquids, and vapors, and irreversibility.
Prerequisites: (MATH 2414 or MATH 2024) and (PHYS 2325 or PHYS 2513).

MCEG 2302 Engineering Mechanics II: 3 semester hours.
Kinematics and kinetics of particles and of rigid bodies as applied to engineering problems; Newton's laws of motion; work and energy; impulse and momentum; translations; rotation; plane motion; motion about a point; general motions; and periodic motions.
Prerequisites: CVEG 2301 or CVEG 2043.

MCEG 2303 Materials Science and Engineering: 3 semester hours.
Science concepts of crystal structures, atomic scale defects, bonding, phase diagrams and solidification. Relationship between microstructure and thermal, mechanical, optical, electrical and magnetic properties of materials.
Prerequisites: (CHEM 1303 or CHEM 1033) or (CHEM 1403 or CHEM 1034) or (CHEM 1304 or CHEM 1043).

MCEG 3101 Measurement and Instrumentation Laboratory: 1 semester hour.
The scope of this course includes fundamentals in measurement theory, statistical analysis of experimental data, uncertainty, accuracy assessments, and calibration techniques. The course includes the use and applications of instruments for measuring area, pressure, time, speed, temperature, strain, hardness, and deflection.
Prerequisites: (PHYS 2325 or PHYS 2513) and (PHYS 2125 or PHYS 2511) and (PHYS 2126 or PHYS 2521).

MCEG 3102 Thermal Science Laboratory: 1 semester hour.
This course includes experimental investigation of the performance of various thermal systems, such as engines, combustion unit, heat exchangers, nozzles, boilers and turbo machinery.
Prerequisites: (MCEG 3101 or MCEG 3011) and (MCEG 3301 (may be taken concurrently) or MCEG 3013 (may be taken concurrently)) and (ELEG 1304 (may be taken concurrently) or ELEG 1043 (may be taken concurrently)).

MCEG 3103 Manufacturing Processes Laboratory: 1 semester hour.
This lab includes experiments for metal identification, machinability of materials, effects of factors on surface roughness measurement, material removal rates, and cutting tool force analysis. It also includes illustrations of casting, forging, rolling, and powder metallurgy. Student will be required to design a structure part and perform manufacturing operations.
Co-requisite: MCEG 3303.

MCEG 3301 Heat Transfer: 3 semester hours.
Study of the fundamental modes of heat transfer, conduction, convection, and thermal radiation, separately and in combination. Theoretical, numerical, and design methods of analysis of steady, transient, single, and multidimensional problems will be emphasized.
Prerequisites: (MATH 2320 or MATH 2043) and (MCEG 3306 or MCEG 3063).

MCEG 3302 Thermodynamics II: 3 semester hours.
Continuation of Thermodynamics I, including various power cycles, refrigeration cycles, fluid flow, combustion process, and advanced concepts of gas dynamic, such as shock waves.
Prerequisites: (MCEG 2301 or MCEG 2013) and (MATH 2414 or MATH 2024).

MCEG 3303 Manufacturing Processes: 3 semester hours.
This course provides the concepts for the conversion of materials into products. It includes measurement and quality assurance, and processes of casting, forming, material removal, and joining. In addition, it involves the study of computer numerical control machines, manufacturing systems, and automation.
Prerequisites: MCEG 2303 or MCEG 2023.

MCEG 3304 Machine Design I: 3 semester hours.
Fundamentals of mechanical design methodology, design of machine elements for static and fatigue failure, individual projects and classroom discussions of various design solutions.
Prerequisites: (CVEG 2332 or CVEG 2063) and (MCEG 1102 or MCEG 1021).

MCEG 3305 Kinematic Design and Analysis: 3 semester hours.
This course includes the theory and application for the kinematic design of mechanisms. The students will be required to use computers to model, analyze, and synthesize mechanical systems.
Prerequisites: (MCEG 1102 or MCEG 1021) and (MCEG 2302 or MCEG 2053).

MCEG 3306 Fluid Mechanics: 3 semester hours.
The fundamental conservation laws in fluid statics and dynamics are derived and solved analytically and numerically. Other topics include: analysis of viscous and inviscid flow; laminar and turbulent flows in pipes and on external surfaces; open channel flow; hydraulic machinery; and introduction to compressible flow. Direct applications to problems encountered in practice and in engineering design will be covered. Problem solving and design application will be emphasized.
Prerequisites: (MCEG 2301 or MCEG 2013) and (MATH 2320 (may be taken concurrently) or MATH 2043 (may be taken concurrently)) and (MCEG 2302 (may be taken concurrently) or MCEG 2053 (may be taken concurrently)).

MCEG 3307 Automatic Controls: 3 semester hours.
Analysis and synthesis of continuous time control systems, transfer function, block diagrams, stability, root locus, state space representation, and design considerations for feedback control system.
Prerequisites: MATH 4317 (may be taken concurrently) or MATH 4173 (may be taken concurrently).

MCEG 3312 Renewable Energy and Energy Sustainability: 3 semester hours.
The topics of various types of renewable energies, energy conversion, utilization and storage technologies, such as wind, solar, biomass, fuel cells and hybrid systems. For each source, the physical and technological principles are explained and the economics, environmental impacts and future prospects are examined. The course explores the main factors likely to influence the long-term evolution of the world's energy systems and the technologies and policies that could be adopted to create more sustainable energy systems.
Prerequisites: CHEG 3311 or CHEG 3113.

MCEG 3319 Introduction to Robotics: 3 semester hours.
Fundamental topics in Robotics covering configuration (forward and reverse) kinematics, motion kinematics, force/torque relations and trajectory planning. Rudiments of dynamics and position control are also introduced.
Prerequisites: MATH 4317 (may be taken concurrently) or MATH 4173.

MCEG 3615 Mechanical Engineering Internship I: 6 semester hours.
An internship program of work experience with an approved engineering firm.

MCEG 4247 Senior Design and Professionalism-1: 2 semester hours.
This is the first course of a two-semester capstone experience (MCEG 4482 must immediately follow MCEG 4472 or sequence must restart with MCEG 4472) involving engineering design of an industrial or advanced team project. Elements of ethics and professionalism in engineering practice are integrated into the project experience. The project will include application of relevant engineering codes and standards, as well as realistic constraints. Design achievements are demonstrated with written reports, and oral presentation, and professional standards and ethics examinations.
Prerequisites: (MCEG 3304 or MCEG 3043) and (MCEG 3101 or MCEG 3011) and (MCEG 3302 or MCEG 3023).
Co-requisite: MCEG 3301.

MCEG 4248 Senior Design and Professionalism II: 2 semester hours.
A continuation of MCEG 4472 with required design modifications of the team projects necessary to produce a working prototype of the designs initiated in Senior Design and Professionalism I. Design project deliverables include an oral presentation, a final written report and demonstration of prototype, or model of the design. Elements of professionalism reinforce the importance of professional engineering ethics, corporate culture, life-long learning, and globalization.
Prerequisites: MCEG 4247 or MCEG 4472.

MCEG 4304 Machine Design II: 3 semester hours.
This is a design course featuring a design project using strength of materials, kinematics of machines, machine element design (e.g. gears and shafts), and CAD.
Prerequisites: (MCEG 3304 or MCEG 3043) and (MCEG 3305 (may be taken concurrently) or MCEG 3053 (may be taken concurrently)).

MCEG 4306 Dynamic Systems and Controls: 3 semester hours.
The scope of this course includes mathematical modeling, analysis, and feedback control of dynamic systems. Topics include free and force vibrations of single and multiple degrees of freedom systems. Transient, steady-state, and stability of linear feedback control systems will be studied in the course.
Prerequisites: (MCEG 2302 or MCEG 2053) and (MATH 2043 or MATH 2320).

MCEG 4309 Finite Element Analysis and Design: 3 semester hours.
An introduction to finite element analysis as a modern computational tool to solve boundary value problems. Applications will be in structural mechanics, fluid flow, and heat transfer. Design and computer projects included.
Prerequisites: (CVEG 2332 or CVEG 2063) and (MCEG 3301 (may be taken concurrently) or MCEG 3013 (may be taken concurrently)).

MCEG 4316 Special Topics: 3 semester hours.
Selected current and emerging topics in mechanical engineering depending on need determined by the department.

MCEG 4318 Gas Dynamics: 3 semester hours.
Fundamentals in compressible fluid flow, one dimensional and two dimensional flows, subsonic and supersonic flow. Topics include isentropic flow, normal and oblique shock, Prandtl-Meyer Flow, flow with friction and heat transfer, and various engineering applications.
Prerequisites: MCEG 3302 (may be taken concurrently) or MCEG 3023 and (MCEG 3306 or MCEG 3063).

MCEG 4615 Mechanical Engineering Internship II: 6 semester hours.
Continuation of MCEG 3156.

MCEG 5302 Advanced Thermodynamics: 3 semester hours.
Theories of thermodynamics and their application to the more involved problems in engineering practice or design. Topics include advanced power cycles, superconductivity, thermodynamic relations, chemical thermodynamics and phase equilibrium.

MCEG 5303 Advanced Machine Design: 3 semester hours.
A systematic approach to machine design is studied in detail. Topics include systematic steps for planning and design, methods for developing and evaluating solutions, conceptual design, embodiment design, and product life cycle.

MCEG 5312 Advanced Combustion Processes: 3 semester hours.
Advanced Combustion Processes will cover the advanced treatment of fundamental combustion and flame processes, conservation equations for reacting gas mixtures, reaction-kinetic processes that govern combustion rates, the structure of diffusion and premixed flames, and the dynamics of droplet evaporation and combustion. Topics covered include thermochemistry, heat and mass transfer, chemical kinetics, laminar premixed and diffusion flames, droplet burning. Optional topics may include turbulent flames, burning of solids, or complex combustion systems.

MCEG 5316 Advanced Engineering Fluid Dynamics: 3 semester hours.
A comprehensive study of fluid mechanics and dynamics is considered. This includes Potential flow, Stokes flow, Oseen flow, other inviscid flow, Echkman Row, and other viscous flows such as Boundary Layer Analysis. An introduction to perturbation to theory will also be given.

MCEG 5318 Computer Integrated Manufacturing: 3 semester hours.
A total integration of manufacturing, management, strategic planning, finance, and the effective use of computer technology in the control of the production process.

MCEG 5322 Advanced Heat Transfer: 3 semester hours.
An advanced study of heat and mass diffusion, convection, conjugate heat transfer, heat exchangers two-phase heat transfer, micro-scale heat and mass transfer, and thermal radiation. Lumped, integral, differential, and numerical analysis will be included and a term project will be required.

MCEG 5324 Dynamics of Engineerng Systems: 3 semester hours.
Modeling and manipulation of dynamic engineering systems, basic component models, system models, state-space equations, analysis of linear systems, and nonlinear simulation.

MCEG 5325 Advanced Engineering Materials: 3 semester hours.
Qualitative and quantitative relationships between microstructure and mechanical properties. Studies of dislocation theory, elasticity, plasticity, brittle and ductile fracture, fatigue and creep, design criteria and statistical aspects of failure.

MCEG 5326 Robotics: 3 semester hours.
Topics in Robotics covering configuration (forward and reverse) kinematics, Jacobians (velocities and static forces), force/torque relations, trajectory planning, dynamics and position control.

MCEG 5332 Multiphase Flow and Heat Transfer: 3 semester hours.
Multiphase Flow and Heat Transfer will cover the advanced treatment of fundamental aspects of heat, mass, and momentum transfer in multiphase flow systems. Topics include conservation laws, flows with particles, drops and bubbles, boiling, and condensation.

MCEG 5333 Computational Fluid Dynamics: 3 semester hours.
Potential flow theory. Application of numerical methods and the digital computer to inviscid flow analysis. Application of vortex lattice, panel element, and boundary element methods to incompressible and compressible three dimensional aerodynamic flow problems. Wings and Wing-body analysis and incorporation of boundary integration for complete modeling.