Electrical and Computer Engineering

Electrical Engineering

The primary purpose of the Electrical Engineering Program is to prepare students for a successful professional career in electrical engineering. The curriculum is structured to provide each student with a sound background in mathematics, physical sciences, engineering sciences, and a thorough foundation in electrical engineering for the analysis and design of electrical and electronic circuits and systems.

The program educational objectives of the Electrical Engineering program at Prairie View A&M University are:

1. To produce graduates for successful careers in Electrical Engineering and other related fields.
2. To produce graduates who engage in self-development activities through professional study and personal research that will allow them to adapt to evolving technological challenges.
3. To produce graduates who can successfully complete graduate degrees in Electrical Engineering or other disciplines that they may choose.

Computer Engineering

Computer Engineering is a field of engineering that is mainly concerned with applying computer hardware and software to solve practical problems. The primary purpose of the Computer Engineering Program is to prepare students for a successful professional career in the field of computer engineering. The curriculum is structured to provide each student with a strong foundation in the basic sciences of chemistry, mathematics, and physics. In addition, Computer Engineering students will take courses in the following areas: electric circuits, electronics, digital logic circuits, computer organization and architecture, computer interfacing, programming languages, data structures, operating systems, software engineering, and microprocessor systems.

The program educational objectives of the Computer Engineering program at Prairie View A&M University are:

1. To produce graduates for successful careers in Computer Engineering and other related fields.
2. To produce graduates who engage in self-development activities through professional study and personal research that will allow them to adapt to evolving technological challenges.
3. To produce graduates who can successfully complete graduate degrees in Computer Engineering or other disciplines that they may choose.

Admission Requirements

Table 1. First-time Freshmen Requirements for Direct Admission to the Computer and Electrical Engineering Programs

Academic Major	Meet PVAMU Admission Standards	High School GPA	SAT/ACT	High School Rank	THEA Passed
Computer and Electrical Engineering	Yes	3.00	New SAT: 950/18	Top 25%	(TSI) All Sections

Table 2. Transfer Students Requirements for Direct Admission to the Computer and Electrical Engineering Programs

Academic Major	Meet PVAMU Admission Standards	Transfer Grades	Transfer GPA (Math; Science and Engineering)
Computer and Electrical Engineering	Yes	"C" or greater	2.50

These tables represent a summary of admission requirements. For more detailed requirements see the section in the catalog pertaining to the Roy G. Perry College of Engineering Admission.

Accreditation Status

The Electrical Engineering program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org. (https://www.abet.org/)

Bachelor of Science in Electrical Engineering Degree Program Requirements

BS Electrical Engineering Recommended Degree Sequence (http://catalog.pvamu.edu/academicprogramsanddegreeplans/roygperrycollegeofengineering/electricalandcomputerengineering/ELEG_BSEE_21-22.pdf)

Core Curriculum [1, 2]		**42**
College and Support Area Requirements		
MATH 2413	Calculus with Analytic Geometry I [2]	1
MATH 2320	Differential Equations	3

MATH 2414	Calculus with Analytic Geometry II	4
MATH 3302	Probability and Statistics	3
MATH 4317	Advanced Math for Engineers	3
CHEM 1112 & CHEM 1403	General Chemistry Lab II and Chemistry for Engineers	5
PHYS 2125 & PHYS 2126	University Physics Lab I and University Physics Lab II	2
ELEG 1101	Intro Engr Computer Sci & Tech	1
ELEG 1102	Introduction to Electrical and Computer Engineering Laboratory	1
ELEG 2305	Network Theory I	3
MCEG 2301	Thermodynamics I	3
Select one of the following:		**4**
ELEG 4247 & ELEG 4248	Senior Design and Professionalism I and Senior Design and Professionalism II	
CHEG 4247 & CHEG 4248	Senior Design and Professionalism -I and Senior Design and Professionalism - II	
CVEG 4200 & CVEG 4201	Senior Design and Professionalism - I and Senior Design and Professionalism - II	
MCEG 4247 & MCEG 4248	Senior Design and Professionalism-1 and Senior Design and Professionalism II	
Major Requirements		
ELEG 1304	Computer Applications in Engineering	3
ELEG 2101	Electric Circuits Laboratory	1
ELEG 2131	Logic Circuits Lab	1
ELEG 2311	Logic Circuits	3
ELEG 3301	Network Theory II	3
ELEG 3302	Signals and Systems	3
ELEG 3303	Physical Principles of Solid State Devices	3
ELEG 3304	Electronics I	3
ELEG 3107	Microprocessor Systems Design Laboratory	1
ELEG 3307	Microprocessor System Design	3
ELEG 4300	Communication Theory	3
ELEG 4101	Electronics Laboratory	1
ELEG 4302	Power Systems Engineering	3
ELEG 4305	Electromagnetic Field Theory I	3
ELEG 4304	Electronics II	3
ELEG 4307	Servomechanism and Control Systems	3
Technical Electives		**9**
Electrical and Computer Engineering Laboratory Elective		**2**
Total Hours		126

[1] Students in the Electrical Engineering Program are required to take PHYS 2325 and PHYS 2326 to satisfy the Natural Science requirements, CVEG 2304 to satisfy the Global Awareness requirement, MATH 2413 to satisfy Mathematics requirement, and CHEG 2308 to satisfy Social and Behavioral Science requirement.

[2] Three hours of MATH 2413 Calculus and Analytical Geometry I counts toward the core curriculum and one hour of MATH 2413 counts toward the College and Support Area Requirements.

Electrical Engineering Suggested Technical Electives

At least one technical elective must be taken in the Electrical Engineering Department. In addition, one Electrical Engineering Laboratory elective should be taken to satisfy degree requirements. Internship and co-op courses are not suitable for technical electives.

Microelectronics Area		
ELEG 4322	Electronic and Photonic Materials and Devices	3
ELEG 4336	Introduction to High Performance Computing	3

ELEG 4339	Computer Organization and Design	3
Communications/Signal Processing Area		
Computer Engineering Area		
ELEG 4339	Computer Organization and Design	3
ELEG 4325	Computer Interfacing and Communications	3
ELEG 4336	Introduction to High Performance Computing	3
ELEG 4335	Advanced Logic Design	3
Power and Control Systems Area		
ELEG 4324	Power Electronics	3
ELEG 4302	Power Systems Engineering	3
Electrical and Computer Engineering Laboratory Electives		
ELEG 3104	Microelectronic Processing and Characterization Lab	1
ELEG 4102	Power Laboratory	1
ELEG 4131	Advanced Logic Design Laboratory	1
Other Technical Electives		
CVEG 4304	Systems Engineering	3
MCEG 3302	Thermodynamics II	3
MCEG 3306	Fluid Mechanics	3
MATH 4306	Numerical Analysis	3
MATH 3307	Linear Algebra	3
ELEG 4310	Special Topics [1]	3

[1] Special topics courses vary in content and may cover areas such as artificial intelligence, machine learning, cybersecurity, and power systems.

Technical Electives through Five-Year BS/MS Degree Plan Option

Students may, upon approval to the Five-Year BS/MS Degree Plan (https://www.pvamu.edu/engineering/departments/five-year-bsms-programs/) Option, apply up to six semester credit hours of graduate courses toward technical electives requirements.

Eligibility to Take Upper Division College Courses

The Roy G. Perry College of Engineering requires 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 level) courses in the Roy G. Perry College of Engineering. The following course must be completed or currently enrolled in prior to enrolling in upper division courses:

CHEG 2308	Eco Anal Technical Application	3
CHEM 1112	General Chemistry Lab II	1
CHEM 1403	Chemistry for Engineers	4
COMM 1311	Introduction to Speech Communication	3
ELEG 1101	Intro Engr Computer Sci & Tech	1
ELEG 1102	Introduction to Electrical and Computer Engineering Laboratory	1
ELEG 1304	Computer Applications in Engineering	3
ELEG 2101	Electric Circuits Laboratory	1
ELEG 2305	Network Theory I	3
ENGL 1301	Freshman Composition I	3
ENGL 2311	Technical and Business Writing	3
MATH 2413	Calculus with Analytic Geometry I	4
MATH 2414	Calculus with Analytic Geometry II	4
MATH 2320	Differential Equations	3
MCEG 2301	Thermodynamics I	3
PHYS 2125	University Physics Lab I	1
PHYS 2126	University Physics Lab II	1
PHYS 2325	University Physics I	3

PHYS 2326	University Physics II	3
Total Hours		48

Bachelor of Science in Computer Engineering Degree Program Requirements

BS Computer Engineering Recommended Degree Sequence (http://catalog.pvamu.edu/academicprogramsanddegreeplans/roygperrycollegeofengineering/electricalandcomputerengineering/CPEG_BS_21-22.pdf)

Core Curriculum [1, 2]		**42**
College and Support Area Requirements		
MATH 2320	Differential Equations	3
MATH 2413	Calculus with Analytic Geometry I [2]	1
MATH 2414	Calculus with Analytic Geometry II	4
MATH 2305	Discrete Mathematics	3
MATH 3302	Probability and Statistics	3
CHEM 1112 & CHEM 1403	General Chemistry Lab II and Chemistry for Engineers	5
PHYS 2125 & PHYS 2126	University Physics Lab I and University Physics Lab II	2
ELEG 1101	Intro Engr Computer Sci & Tech	1
ELEG 1102	Introduction to Electrical and Computer Engineering Laboratory	1
ELEG 2305	Network Theory I	3
Select one of the following:		**4**
ELEG 4247 & ELEG 4248	Senior Design and Professionalism I and Senior Design and Professionalism II	
CHEG 4247 & CHEG 4248	Senior Design and Professionalism -I and Senior Design and Professionalism - II	
CVEG 4200 & CVEG 4201	Senior Design and Professionalism - I and Senior Design and Professionalism - II	
MCEG 4247 & MCEG 4248	Senior Design and Professionalism-1 and Senior Design and Professionalism II	
Major Requirements		
ELEG 1301	Programming for Computer Engineering I	3
ELEG 1321	Programming for Computer Engineering II	3
ELEG 2101	Electric Circuits Laboratory	1
ELEG 2321	Data Structure and Algorithm with Python	3
ELEG 2331	Advanced Programming and Applications	3
ELEG 3301	Network Theory II	3
ELEG 2131	Logic Circuits Lab	1
ELEG 2311	Logic Circuits	3
ELEG 3302	Signals and Systems	3
ELEG 3303	Physical Principles of Solid State Devices	3
ELEG 3304	Electronics I	3
ELEG 3107	Microprocessor Systems Design Laboratory	1
ELEG 3307	Microprocessor System Design	3
ELEG 4325	Computer Interfacing and Communications	3
ELEG 4330	Introduction to Digital Design	3
ELEG 4333	Communication Network Engineering	3
ELEG 4339	Computer Organization and Design	3
Technical Electives		**9**
Total Hours		126

1 Students in the Computer Engineering Program are required to take PHYS 2325 and PHYS 2326 to satisfy the Natural Science requirements, CVEG 2304 to satisfy the Global Awareness requirement, MATH 2413 to satisfy Mathematics requirement, and CHEG 2308 to satisfy Social and Behavioral Science requirement.

[2] Three hours of MATH 2413 Calculus and Analytical Geometry I counts toward the core curriculum and one hour of MATH 2413 counts toward the College and Support Area Requirements.

Computer Engineering Suggested Technical Electives

All computer engineering majors must select one technical elective. Internship and co-op courses are not acceptable as technical electives.

COMP 3306	Operating Systems	3
COMP 3322	Software Engineering	3
COMP 4395	Data Base Management	3
ELEG 4335	Advanced Logic Design	3
MATH 3307	Linear Algebra	3
ELEG 4310	Special Topics [1]	3
ELEG 4361	Design of Digital System Applications Using Field Programmable Gate Array Devices	3
ELEG 4371	Foundation and Application of Internet of Things	3
ELEG 4377	Machine Learning for Engineering Applications	3
ELEG 4378	Mobile Edge Computing	3

[1] Special topics courses vary in content and may cover areas such as artificial intelligence, machine learning, cybersecurity, and power systems.

Technical Electives through Five-Year BS/MS Degree Plan Option

Students may, upon approval to the Five-Year BS/MS Degree Plan (https://www.pvamu.edu/engineering/departments/five-year-bsms-programs/) Option, apply up to six semester credit hours of graduate courses toward technical electives requirements.

Eligibility to Take Upper Division College Courses

The Roy G. Perry College of Engineering requires 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 level) courses in the Roy G. Perry College of Engineering. The following courses must be completed or currently enrolled in prior to enrolling in upper-division courses:

CHEG 2308	Eco Anal Technical Application	3
CHEM 1403	Chemistry for Engineers	4
CHEM 1112	General Chemistry Lab II	1
ELEG 1301	Programming for Computer Engineering I	3
ELEG 1321	Programming for Computer Engineering II	3
ELEG 2321	Data Structure and Algorithm with Python	3
ELEG 2331	Advanced Programming and Applications	3
ELEG 1101	Intro Engr Computer Sci & Tech	1
ELEG 1102	Introduction to Electrical and Computer Engineering Laboratory	1
ELEG 2101	Electric Circuits Laboratory	1
ELEG 2305	Network Theory I	3
ENGL 1301	Freshman Composition I	3
ENGL 2311	Technical and Business Writing	3
MATH 2413	Calculus with Analytic Geometry I	4
MATH 2414	Calculus with Analytic Geometry II	4
MATH 2320	Differential Equations	3
MATH 2305	Discrete Mathematics	3
PHYS 2125	University Physics Lab I	1
PHYS 2325	University Physics I	3
PHYS 2126	University Physics Lab II	1
PHYS 2326	University Physics II	3

Purpose and Goals

The primary purpose of the Electrical Engineering graduate programs is to enhance students' skills in specialized areas and provide opportunities for students to pursue careers in private industry, government research laboratories and design facilities.

The objectives of the program are:

- To produce graduate students who have advanced training in one of the following areas of emphasis in Electrical Engineering: (i) Microelectronics, (ii) Computer Engineering, (iii) Telecommunications and Signal processing, (iv) Energy and Power Systems, (v) Cybersecurity, and (vi) Bioinformatics.
- To produce a significant number of graduates with experience in research.
- To prepare outstanding students to pursue doctoral degrees.
- To produce post-graduates who have the technical, cognitive and interpersonal skills that will allow them to secure employment within the State of Texas, or in the nation.

Graduate Certificate in Deep Learning for Artificial Intelligence

Required Courses		
ELEG 6316	Statistical Learning for Big Data	3
ELEG 6318	Deep Learning	3
ELEG 6360	Modern Artificial Intellegence	3
Elective Courses (choose 3 below):		**9**
COMP 5314	Advanced Database Management System	
COMP 5315	Design and Analysis of Algorithms	
COMP 5327	Data Mining	
COMP 5329	Text Mining	
CINS 5317	Information Retrieval	
ELEG 6311	Computer Architecture & Advanced Logic Design	
ELEG 6312	The Internet: Design and Implementation	
ELEG 6315	Information Networks	
ELEG 6320	Wireless Networks	
ELEG 6331	Stochastic Processes	
Total Hours		18

Master of Science in Electrical Engineering Degree Program Requirements

General Requirements		
Select two of the following:		6
GNEG 5304	Engineering Probability and Statistics	
GNEG 5306	Engineering Analysis I	
GNEG 5307	Engineering Analysis II	
GNEG 5313	Engineering Numerical Methods	
Technical Electives (see list of technical elective options below)		
At least two technical electives must be taken in the Electrical Engineering department		12
Concentration (select one concentration from below):		**12**
Total Hours		30

Thesis Concentration

ELEG 5699	Thesis	6
Select two classes from one of the tracks listed below:		6
Computer Engineering Track		
ELEG 6310	Advanced Computer Systems Design	
ELEG 6311	Computer Architecture & Advanced Logic Design	
ELEG 6312	The Internet: Design and Implementation	
ELEG 6314	Fault Tolerant Computing	
ELEG 6315	Information Networks	
Communication and Signal Processing Track		
ELEG 6320	Wireless Networks	
ELEG 6321	Digital Communication	
ELEG 6324	Advanced Broadband Communications Systems	

ELEG 6331	Stochastic Processes	
ELEG 6322	Coding Theory	
ELEG 6333	Wavelets and Their Applications	
Microelectronics Track		
ELEG 6350	Advanced Photonics Materials and Devices	
ELEG 6351	Advanced Quantum Devices	
ELEG 6342	VLSI and ULSI Design	
ELEG 6352	Advanced Characterization of Materials and Devices	
ELEG 6354	Advanced Solid State	
Power Engineering Track		
ELEG 6371	Power System Faults Protective	
ELEG 6372	Power System Stability	
ELEG 6373	High Voltage Direct Current	
ELEG 6374	Power Gen Oper Control	
ELEG 6375	Advanced Power System	
ELEG 6376	Power Electronics Power System	
ELEG 6377	Advanced Electric Drives	
ELEG 6378	Advanced Power Electronics	
Total Hours		12

Non-Thesis Concentration

ELEG 5391	Engineering Project	3
Select three classes from one of the tracks listed below:		**9**
Computer Engineering Track		
ELEG 6310	Advanced Computer Systems Design	
ELEG 6311	Computer Architecture & Advanced Logic Design	
ELEG 6312	The Internet: Design and Implementation	
ELEG 6314	Fault Tolerant Computing	
ELEG 6315	Information Networks	
Communication and Signal Processing Track		
ELEG 6320	Wireless Networks	
ELEG 6321	Digital Communication	
ELEG 6322	Coding Theory	
ELEG 6324	Advanced Broadband Communications Systems	
ELEG 6331	Stochastic Processes	
ELEG 6333	Wavelets and Their Applications	
Microelectronics Track		
ELEG 6342	VLSI and ULSI Design	
ELEG 6350	Advanced Photonics Materials and Devices	
ELEG 6351	Advanced Quantum Devices	
ELEG 6352	Advanced Characterization of Materials and Devices	
ELEG 6354	Advanced Solid State	
Power Engineering Track		
ELEG 6371	Power System Faults Protective	
ELEG 6372	Power System Stability	
ELEG 6373	High Voltage Direct Current	
ELEG 6374	Power Gen Oper Control	
ELEG 6375	Advanced Power System	
ELEG 6376	Power Electronics Power System	
ELEG 6377	Advanced Electric Drives	

ELEG 6378	Advanced Power Electronics	
Total Hours		12

Technical Electives

Electrical Engineering Technical Electives		
ELEG 6310	Advanced Computer Systems Design	3
ELEG 6311	Computer Architecture & Advanced Logic Design	3
ELEG 6312	The Internet: Design and Implementation	3
ELEG 6314	Fault Tolerant Computing	3
ELEG 6315	Information Networks	3
ELEG 6320	Wireless Networks	3
ELEG 6321	Digital Communication	3
ELEG 6322	Coding Theory	3
ELEG 6324	Advanced Broadband Communications Systems	3
ELEG 6325	Telecommunications Network Security	3
ELEG 6330	Signal Detection and Estimation	3
ELEG 6331	Stochastic Processes	3
ELEG 6333	Wavelets and Their Applications	3
ELEG 6342	VLSI and ULSI Design	3
ELEG 6350	Advanced Photonics Materials and Devices	3
ELEG 6351	Advanced Quantum Devices	3
ELEG 6352	Advanced Characterization of Materials and Devices	3
ELEG 6354	Advanced Solid State	3
ELEG 6371	Power System Faults Protective	3
ELEG 6372	Power System Stability	3
ELEG 6373	High Voltage Direct Current	3
ELEG 6374	Power Gen Oper Control	3
ELEG 6375	Advanced Power System	3
ELEG 6376	Power Electronics Power System	3
ELEG 6377	Advanced Electric Drives	3
ELEG 6378	Advanced Power Electronics	3
ELEG 6391	Special Topics in Elec Engr [1]	3
Other Technical Electives		
CHEG 5302	Microelectronics Materials	3
CINS 5306	Data Structures and Algorithms	3
COMP 5315	Design and Analysis of Algorithms	3
COMP 5324	Distributed Computing and Parallel Processing	3
CVEG 5300	Physical/Chemical Unit Operations in Water and Wastewater Treatment	3
CVEG 5303	Finite Element Analysis	3
GNEG 5304	Engineering Probability and Statistics	3
GNEG 5306	Engineering Analysis I	3
GNEG 5307	Engineering Analysis II	3
GNEG 5313	Engineering Numerical Methods	3
GNEG 5319	Special Topics	3
MCEG 5302	Advanced Thermodynamics	3
MCEG 5325	Advanced Engineering Materials	3

[1] Special topics courses vary in content and may cover areas such as artificial intelligence, machine learning, cybersecurity, and power systems.

Doctor of Philosophy in Electrical Engineering Degree Program

Purpose and Goals

The Doctor of Philosophy program in Electrical Engineering is designed to prepare students to be scholars, to develop the students' capacities to understand issues and problems at the frontiers of knowledge, and to make significant contributions to that knowledge. The PhD program's overall educational goals are to provide doctoral training in Electrical Engineering research, to develop new knowledge in engineering, and to disseminate the knowledge gained.

The educational objectives of the PhD in Electrical Engineering program are:

1. To produce competent engineering researchers who can communicate new and innovative research findings to engineers and scientists,
2. To train engineers who are well versed in the general body of knowledge in Electrical Engineering,
3. To produce researchers with specialized knowledge in Electrical Engineering, and
4. To increase the number of Electrical Engineering doctorates.

Program Requirement

The minimum required coursework beyond the Master's degree is 53 semester credit hours (SCH). This credit hour requirement includes coursework prescribed for students in support of an area of concentration (9 SCH), free electives in support of doctoral dissertation and specialization (15 SCH), doctoral research (12 SCH), dissertation (12 SCH), stochastic process course (3 SCH) and graduate seminars (2 SCH). Courses taken during a master's degree program may not be repeated for credit at the doctoral level

Student Advisement and Supervision

The Electrical and Computer Engineering Graduate Program Administrator will serve as the Graduate Advisor of each student upon admission into the PhD program. After the student completes nine hours of doctoral classwork, the student will be required to choose a chairperson of the student's Ph.D. Advisory committee. The student will select the members of the student's PhD committee in consultation with the Graduate Program Administrator and the chairperson of the student Ph.D. committee. The chair of the individual doctoral student's committee is responsible for advising that student for courses taken beyond the first nine credit hours.

Doctoral Advisory Committee

The Graduate Program Administrator will assist the graduate student in securing an Academic Advisor, who will act as the Chair of the Doctoral Advisory Committee and will be responsible for advising and supervising the student. After the student has successful completed the qualifying examination, the Chair of the Doctoral Advisory Committee and the student will select the Doctoral Advisory Committee, consisting of five graduate faculty members. One member of the doctoral advisory committee will be chosen from outside the department of Electrical Engineering. The choice of the outside faculty members will be based on the individual student needs and the selected dissertation topic. The chair and the student will follow the procedure established by the Office of Graduate Studies.

The Doctoral Advisory Committee will develop a tentative timetable for completion of all requirements for the degree program; monitor the student's coursework and research; provide advice and feedback to the student; file an Annual Report of the student's progress with the Office of the Dean of the College of Engineering; approve a research topic; supervise the preparation of the research project; uphold the standards of the College and the University; inform the Dean of the College of Engineering, in writing, if a student's performance is inadequate and provide relevant advisory committee recommendations; and formulate and conduct the preliminary and qualifying examinations. The student's Advisory Committee Chair acts as head of the Doctoral Advisory Committee and takes the lead in completing these duties. The procedures published by the Office of Graduate Studies must be followed.

Graduate Plan of Study

Each doctoral student will be required to file a Graduate Study Plan (GSP) with the College of Engineering before completing 18 semester hours of course work. The GSP outlines the curriculum of study and a timetable to be followed by the doctoral student in meeting the graduate degree requirements. The student prepares the GSP in consultation with the Doctoral Advisory Committee and Office of Graduate Studies guidelines.

Preliminary Examination

When the student has completed nine (9) semester hours of coursework or two semesters in the doctoral program, he or she will be required to take a preliminary examination. The preliminary examination will be taken at the beginning of the second semester of the student's doctoral program. The preliminary examination will be a written test of knowledge in at least three areas of electrical engineering. The student will choose from the following areas: Microelectronics, Computer Networks, Power Engineering, Control Systems, Communications, Digital Systems, Engineering Mathematics, and Signal Processing. The preliminary examination will be prepared and administered by the Graduate Program Administrator and graduate faculty. Students failing any portion of the preliminary examinations must consult with the Graduate Program Administrator to determine the steps to be taken. Two consecutive failures on the examination will result in the student's dismissal from the PhD program.

Qualifying Examination

A doctoral student will be required to successfully pass a qualifying examination. The qualifying examination consists of a research proposal, written and oral examinations on the student's area of research. The doctoral student must take a qualifying examination by the time he or she has completed 36 semester hours of coursework. The qualifying examination will be prepared and administered by the Graduate Program Administrator and the student's Doctoral Advisory Committee.

The student must pass either unconditionally or conditionally. A conditional pass indicates specific weaknesses in the student's background that must be remedied before degree requirements are completed. All remedies should be completed within a year after the first attempt at passing the Qualifying examination. Two consecutive failures on the examination will result in the student's dismissal from the PhD program. The Graduate Program Administrator will recommend the doctoral students who pass the qualifying examinations to the Dean of the College of Engineering for admission to candidacy.

Advancement to Candidacy

Following successful completion of the qualifying examinations, it is the student's responsibility to petition for advancement to candidacy. To be advanced to candidacy, students must have completed all of the following requirements and/or procedures:

1. Achieved a cumulative grade-point average of 3.0 or above in program coursework.
2. Successfully passed the preliminary examination.
3. Successfully passed the qualifying examination.

The doctoral student is required to submit the application for advancement to candidacy at least one semester before the doctoral degree is awarded. The admission to graduate study does not imply "advancement to candidacy" for the doctoral degree.

Doctoral Dissertation

Successful completion of the doctoral dissertation is required. Every doctoral student is required to pass an oral defense of the dissertation project. Two attempts at passing the dissertation defense are permitted. Failure to pass the dissertation defense will result in the student's dismissal from the program.

Having met other requirements for the degree, students who successfully defend their dissertations and complete the submission process will be granted the degree of Doctor of Philosophy in Electrical Engineering. The determination of completion requirements for the Doctor of Philosophy degree in Electrical Engineering is solely the province of the program faculty.

The dissertation will not be recommended for final submission to the Dean of the College of Engineering until it has been successfully defended and approved by at least four members of the student's Doctoral Advisory Committee.

Transfer of Graduate Courses from Other Universities

A maximum of six (6) units of electrical engineering-related coursework may be transferred from other accredited universities. A minimum grade of "B" is required in any such courses. Transfer credit is granted by petition to, and approval by, the Doctoral Advisory Committee, with final approval by the Dean of the College of Engineering. It is the student's responsibility to initiate the petition and justify the acceptance of the course. Courses presented for transfer credit must be the equivalent of courses in the doctoral program.

Special Requirements: Residency and Refereed Papers

Every doctoral student will be required to complete, on campus, at least nine (9) months of graduate study beyond the master's degree. The residence requirement is fulfilled through the completion of a full schedule (at least 9 semester hours) of graduate coursework in each of two consecutive semesters (excluding summer months).

Each candidate is required to have submitted at least two papers for publication in refereed journals. The candidate should be the first author of both papers submitted for publication. The papers should be based on the results of the candidate's doctoral research.

Good Standing

PhD students remain in good standing when they maintain a minimum cumulative GPA of 3.0 for graded courses in the doctoral program. Only grades of "B" or better count toward the required course work of the program. If a grade lower than "B" is received in a required course, the course must be retaken. If a second grade lower than "B" is earned, the student will be dismissed from the program but may petition the Graduate Program Administrator and Doctoral Advisory Committee for readmission. After reviewing the petition, the committee may allow readmission under such conditions, as it deems appropriate. A third grade lower than "B" will result in permanent dismissal from the program with no recourse to petition.

Time Limit

A student must complete all requirements for the PhD degree within nine (9) consecutive years after the first date of enrollment in the program. Any exception to this policy requires the approval of the Graduate Program Administrator and the Dean of the College of Engineering.

Financial Assistance

The graduate programs of the Electrical Engineering Department offer a limited number of graduate assistantships to qualified full-time students. Students who receive such an award are required to assist faculty in research projects and/or teach courses in the undergraduate program. Criteria for assignment of master's assistantships include quantitative information (GPA) and qualitative information (undergraduate preparation, publications, and letters of recommendation). Criteria for assignment of doctoral assistantships to new students include quantitative information (graduate GPA and TOEFL scores) and qualitative and/or supplemental information (letters of recommendation, applicant's statement of interest and intent, preparation in the fields of study, academic publications, previous college-level teaching experience, research work in the field, and grant-writing experience). No standardized test scores will be used as the sole criterion for awarding assistantships or for rejecting applicants for assistantships. Student loans are available to graduate students at Prairie View A&M University on the basis of need. For more information about loans and other sources of aid, contact the Office of Student Financial Aid & Scholarships (https://www.pvamu.edu/faid/).

Degree Program Requirements

Required Courses		
ELEG 6101	Graduate Seminar I	1
ELEG 6102	Graduate Seminar II	1
ELEG 6331	Stochastic Processes	3
ELEG 7601	Doctoral Research I	6
ELEG 7602	Doctoral Research II	6
ELEG 7691	Doctoral Dissertation I	6
ELEG 7692	Doctoral Dissertation II	6
Elective Courses Prescribed for Students		
6000 or 7000 level Electrical Engineering courses selected from one of the Electrical Engineering tracks.		9
Free Electives		
5000 to 7000 level graduate courses, but not more than 9 SCH course at the 5000 level will be accepted.		15
Total Hours		53

Courses for Electrical Engineering Tracks

(A) Computer Engineering Track

ELEG 6310	Advanced Computer Systems Design	3
ELEG 6311	Computer Architecture & Advanced Logic Design	3
ELEG 6312	The Internet: Design and Implementation	3
ELEG 6314	Fault Tolerant Computing	3
ELEG 6315	Information Networks	3
ELEG 6365	Intro to High Perf Computing	3
ELEG 7310	Advanced Topics in Computer Engineering	3

(B) Communication and Signal Processing Track

ELEG 6320	Wireless Networks	3
ELEG 6321	Digital Communication	3
ELEG 6322	Coding Theory	3
ELEG 6324	Advanced Broadband Communications Systems	3
ELEG 6325	Telecommunications Network Security	3
ELEG 6330	Signal Detection and Estimation	3
ELEG 6331	Stochastic Processes	3
ELEG 6312	The Internet: Design and Implementation	3
ELEG 6333	Wavelets and Their Applications	3

(C) Microelectronics Track

ELEG 6342	VLSI and ULSI Design	3
ELEG 6350	Advanced Photonics Materials and Devices	3
ELEG 6351	Advanced Quantum Devices	3
ELEG 6352	Advanced Characterization of Materials and Devices	3

ELEG 6354	Advanced Solid State	3
ELEG 6352	Advanced Characterization of Materials and Devices	3

(D) Power Engineering Track

ELEG 6371	Power System Faults Protective	3
ELEG 6372	Power System Stability	3
ELEG 6373	High Voltage Direct Current	3
ELEG 6374	Power Gen Oper Control	3
ELEG 6375	Advanced Power System	3
ELEG 6376	Power Electronics Power System	3
ELEG 6377	Advanced Electric Drives	3
ELEG 6378	Advanced Power Electronics	3

Free Electives

Electrical Engineering Technical Electives

ELEG 6310	Advanced Computer Systems Design	3
ELEG 6311	Computer Architecture & Advanced Logic Design	3
ELEG 6312	The Internet: Design and Implementation	3
ELEG 6314	Fault Tolerant Computing	3
ELEG 6315	Information Networks	3
ELEG 6320	Wireless Networks	3
ELEG 6321	Digital Communication	3
ELEG 6322	Coding Theory	3
ELEG 6324	Advanced Broadband Communications Systems	3
ELEG 6325	Telecommunications Network Security	3
ELEG 6330	Signal Detection and Estimation	3
ELEG 6331	Stochastic Processes	3
ELEG 6333	Wavelets and Their Applications	3
ELEG 6342	VLSI and ULSI Design	3
ELEG 6350	Advanced Photonics Materials and Devices	3
ELEG 6351	Advanced Quantum Devices	3
ELEG 6352	Advanced Characterization of Materials and Devices	3
ELEG 6354	Advanced Solid State	3
ELEG 6371	Power System Faults Protective	3
ELEG 6372	Power System Stability	3
ELEG 6373	High Voltage Direct Current	3
ELEG 6374	Power Gen Oper Control	3
ELEG 6375	Advanced Power System	3
ELEG 6376	Power Electronics Power System	3
ELEG 6377	Advanced Electric Drives	3
ELEG 6378	Advanced Power Electronics	3
ELEG 6391	Special Topics in Elec Engr [1]	3
ELEG 7310	Advanced Topics in Computer Engineering	3
Other Technical Electives		
CHEG 5302	Microelectronics Materials	3
CINS 5306	Data Structures and Algorithms	3
COMP 5315	Design and Analysis of Algorithms	3
CVEG 5300	Physical/Chemical Unit Operations in Water and Wastewater Treatment	3
CVEG 5303	Finite Element Analysis	3
GNEG 5304	Engineering Probability and Statistics	3
GNEG 5306	Engineering Analysis I	3
GNEG 5307	Engineering Analysis II	3

GNEG 5313	Engineering Numerical Methods	3
GNEG 5319	Special Topics [1]	3
MCEG 5302	Advanced Thermodynamics	3
MCEG 5325	Advanced Engineering Materials	3

[1] Special topics courses vary in content and may cover areas such as artificial intelligence, machine learning, cybersecurity, and power systems.

Professional and Honor Societies

The two professional organization in the Electrical and Computer Engineering Department are the *Eta Kappa Nu Electrical Engineering Honor Society* and the *Institute of Electrical and Electronic Engineers (IEEE).*

The Institute of Electrical and Electronic Engineers (IEEE) is a professional society open for membership to engineering students who are majoring in electrical or computer engineering and to other students who have interests in electrical engineering. The chapter is affiliated with the national professional engineering society of the Institute of Electrical and Electronic Engineers.

The Eta Kappa Nu Electrical Engineering Honor Society is a national honor society recognizing academic excellence in future engineers and those engineers who have made outstanding contributions to society. Membership is by invitation to the top junior and senior students majoring in electrical or computer 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 3102 Logic Circuits Laboratory: 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.
Prerequisites: ELEG 3306 (may be taken concurrently) or ELEG 3063.

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 3306 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.
Prerequisites: ELEG 2305 (may be taken concurrently) or ELEG 2023 (may be taken concurrently).
Co-requisite: ELEG 3102.

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 machine 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.
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 and ELEG 4053.

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 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.