Computer Engineering

Undergraduate Handbook

Department of Electrical Engineering and Computer Science

Howard University

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CHAIR'S WELCOME NOTE

Welcome to the Department of Electrical Engineering and Computer Science (EECS) at Howard University. The department offers accredited undergraduate electrical engineering, computer engineering, and computer science programs.

The EECS at Howard University is a dynamic unit of the College of Engineering and Architecture (CEA). Over the years the EECS has established a reputation for excellence in teaching, research, and service to the Howard local, national, and international communities. For many years, the department has been one of the large producers of African-American and minorities engineers at the bachelor, master's and Ph.D. level. The department has some of the most highly regarded centers and laboratories where exciting research in innovative technology continues to attract the local and international students from all over the world. Also, our graduates are sought after by industry and government agencies. Many of our graduates have been accepted in top graduate programs in the nation. A large number of our graduates have moved to leadership positions and academy all over the world.

The department continues to attract and hire outstanding faculty members. We put a special emphasis in our undergraduate programs: We are continually improving our labs, curriculum and advising programs; establishing new mentoring and research programs for undergraduates; and working on developing better relationship with local and national industry.

This handbook for undergraduate computer engineering (CpE) program contains a listing of courses designed for a four-year curriculum and a few other resources that you should find very useful. This handbook does not provide a complete guide to information you need for your day-to-day stay here at Howard. You should consult other university and college publications such as **Student Handbook, and Undergraduate Catalog** for detailed information. You will be assisted by a program academic advisor offered by the Office of Student Success for your course registration. Therefore, you are encouraged to visit the academic advisor as often as possible, at least once per semester for academic matters relating to your courses and career objectives.

You should feel free to visit the EECS Office in Room 1016, L.K. Downing Building and the CEA Office of Student Success in Room 1114, L.K. Downing Building and acquaint yourself with other academic and non-academic resources that are available in the College and the University.

The EECS faculty and staff are committed to continuous improvements of our program. We encourage your comments on all aspects of our program. We are particularly interested in comments regarding program educational objectives, student outcomes and the curriculum.

Again, we welcome you to the CpE program of the EECS and we wish success.

Charles Kim, Ph.D.
Interim Chair and Professor

I. COMPUTER ENGINEERING PROGRAM

A INTRODUCTION

Computer Engineering (CpE) centers on the design, development, and optimization of computer systems and their components, making it an attractive and lucrative profession in this century and beyond. The field encompasses fundamental areas such as computer architecture and computer organization, which form the backbone of modern computing systems, as well as embedded systems that power a wide range of smart devices. It also includes computer networking, enabling communication and data exchange across interconnected systems and the internet. CpE has a rich tradition in the development, testing, and commercialization of advanced technologies, including high-speed machines, microprocessor-based systems, and supercomputers. It contributes to the command, control, and distribution of power and energy systems using intelligent technologies for both terrestrial and non-terrestrial applications. Furthermore, it involves the creation of advanced materials such as superconductors and biomaterials, and plays a key role in the design of very-large-scale integrated (VLSI) circuits for consumer and industrial electronic applications.

Graduates with a bachelor's degree in Computer Engineering find employment across a wide range of industries, including aerospace, communications, computing, power and energy systems, consumer electronics, biomedical engineering, and defense. Many graduates pursue post-baccalaureate studies to obtain advanced degrees in Computer Engineering or related disciplines, further specializing in areas such as computer systems, networking, and embedded systems. Others apply their technical knowledge and problem-solving skills in diverse professional fields beyond engineering, including business, law, and medicine.

The CpE program is fully accredited by ABET. Courses are taught to meet the requirements of ABET for the program. The curriculum for the program is design-based and fully integrated with basic science and math, liberal arts and humanities, and computer engineering core courses. Depth in CpE program is covered in the upper-level courses and CpE elective courses. Foundation courses are covered at sophomore and junior levels.

B MISSION AND EDUCATIONAL OBJECTIVES

EECS Mission

The mission of the Department of Electrical Engineering and Computer Science is that the department strives to:

1. Give students strong background in the fundamentals of computer science, computer engineering, and electrical engineering through high-impact scholarship and research;
2. Expand and diversify the pool of qualified individuals in the engineering profession and to advance knowledge in computer science by providing high quality instruction and conducting research that addresses technical challenges and societal problems;
3. Provide service to the university, the profession, the community, and society while dedicated to promotion of excellence among students, faculty and staff.

CpE Program Educational Objectives

- **Objective 1:** Graduates of the Computer Engineering Program achieve successful careers in Computer Engineering or other fields that require technical and/or professional skills and

knowledge.

- **Objective 2:** Graduates of the Computer Engineering Program pursue continuous professional development, including advanced study and/or research in technical or professional fields.
- **Objective 3:** Graduates of the Computer Engineering Program demonstrate active engagement and leadership within professional/community activities, with a special emphasis on African-American and other underrepresented communities.

CpE Program Student Outcomes

Our CpE program demonstrates that our CpE graduates have:

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

(3) An ability to communicate effectively with a range of audiences.

(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative environment, establish goals, plan tasks, and meet objectives.

(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

These program outcomes, (1) to (7), are consistent with the "Criteria for accrediting engineering programs 2025-2026" Reference Manual.

C Academic Policies and Procedures

Please review the Howard University Academic Policies and Procedures, which are managed by the CEA Office of Student Success and available on the official CEA Academic Policies and Procedures page.

II. Bachelor of Science in Computer Engineering (CpE) Program

A CpE CURRICULUM OVERVIEW

Students seeking the Bachelor of Science degree in Computer Engineering must complete a minimum of 120 credit hours including core courses in Computer Engineering, Computer Science, and Liberal Arts. Elective courses in Computer Engineering, Electrical Engineering, Humanities/Social Science, and African American Studies are also required. The general curriculum is listed below.

Concentration	**Number of Credit Hours**
Computer Engineering Core	60
Computer Engineering Elective	3
Math & Basic Sciences	39
General Education	18
Total	**120**

University Requirements
University-Wide Requirements for graduation include a minimum GPA: 2.0 for all undergraduate coursework. In addition, students must complete last 30 credits at Howard University. In addition, all students must satisfy the Howard University General Education: Essential Learning Outcomes.

Students must complete courses covering all seven outcome areas. These can overlap with other requirements. Note: ELO courses are tagged in Bison Hub under the course description

Howard University General Education: Essential Learning Outcomes

HU ELOs	CpE
ELO 1: U.S. and Global African Diasporic Developments	African American Elective
ELO 2: Human Cultures and Creative Expression	Humanities Electives
ELO 3: The Physical and Natural World	Science Electives
ELO 4: Intellectual and Practical Skills	CpE Core and Tech Electives
ELO 5: Social Responsibility and Political Institutions	Non-Technical Electives - Humanities/Social Science
ELO 6: Leadership and Applied Learning	EECE 401 Senior Project I, EECE 404 Senior Project II
ELO 7: Comprehensive Wellness Practices	EGPP101

B CpE CURRICULUM DETAILS

The computer engineering curriculum contains a broad core of topics, which underlie the practice of engineering and provide a balanced curriculum through integration of studies in mathematics and basic science, engineering science and engineering design, and general studies that meet or exceed expectations of the ABET criterion 5 including the requirement that the curriculum culminate in a major design experience. A total of 120 semester credit hours are required and distributed as follows:

Computer Engineering Core Courses (Total 60 credit hours)

EGPP-101	Intro to Engineering	2
EECE-102	Introduction to Electrical and Computer Engineering	1
EECE-160	Engineering Mathematics	4
EECE-203	Fund Circuit Theory	4
EECE-209	Fund Circuit Theory Lab	1
EECE-305	Fundamentals of Electromagnetics	4
EECE-306	Fundamentals of Electromagnetics Laboratory	1
EECE-309	Fund Electronics and SS	4
EECE-312	Fund Electronics and SS Laboratory	1
EECE-212	Fund Digital Systems	4
EECE-218	Fund Digital Systems Laboratory	1
EECE-260	Engineering Programming & Application	3
EECE-331	Probability and Statistics for Engineering Applications	3
EECE-333	Fund Signals & Systems	4
EECE-401	Senior Design I	3
EECE-404	Senior Design II	3
EECE-406	Advanced Digital Systems Design	3
EECE-412	Advanced Digital Systems Design Laboratory	1
EECE-410	Introduction to Computer Networks	3
EECE-416	Microcomputer Design	3
EECE-417	Computer System Architecture	3
EECE-420	Introduction to VLSI Design	3
EECE-424	Introduction to VLSI Design Lab	1

Basic Math & Sciences (Total 39 credit hours)

MATH-156	Calculus I	4
MATH-157	Calculus II	4
MATH-158	Calculus III	4
MATH-159	Differential Equations	4
MATH-181	Discrete Structures	3
CHEM-003	General Chemistry Lecture	4
CHEM-005	Chemistry Lab.	1
PHYS-013	Physics for Science & Engineers I	3
PHYS-014	Physics for Science & Engineers II	3
PHYS-023	Physics for Science & Engineers I-Lab.	1
PHYS-024	Physics for Science & Engineers II - Lab.	1
CSCI-135	Computer Science I	4
	Math/Science Elective	3

General Education (Total 18 credit hours)

ENGW-104 (102)	Writing Literacy & Discourse	3
ENGW-105 (103)	Reflective Writing Portfolio	3
	African-American Studies Elective	3
ECON-001	Principle of Economics	3
	Humanities Elective	3
	Social Science Elective	3

Elective Courses

I. Computer Engineering Elective Courses (3 hours required)

One (1) 3-credit course is required. Combinations of 1-credit or 2-credit courses do not satisfy the Computer Engineering Elective. Only VIP courses with distinct course numbers are exempt from this rule. Most EECE-4xx and CSCI-4xx courses are accepted; EGPP-4xx courses are NOT accepted. The list is not comprehensive or exhaustive; these courses have been historically offered but may not be available regularly. Please talk to your academic advisor before making a selection.

EECE-446	ASIC Design	3
EECE-456	Embedded Systems Design Lab	3
EECE-465	Neural Networks	3
EECE-466	Robotics	3
EECE-475	Fuzzy Logic	3
EECE-476	Digital Signal Processing	3
EECE-485	Genetic Algorithms	3
EECE-486	Logic Design Testability	3
EECE-498	Independent Project	3
EECE-499	Special Topic in Computer Engineering	3
EECE-900	Industrial Experience	3
CSCI-321	Computer Graphics	3
CSCI-354	Advanced Data Structures	3
CSCI-410	Modeling & Simulation	3
CSCI-470	Analysis of Algorithms	3
CSCI-495	Parallel Processing	3
EECE-101/EECE-201/EECE-302	Faculty-Student Team Project (VIP) course (each 1 cr; take 1 course per semester); 3 VIP courses counted as a 3-credit EE/CpE elective course	3
EECE-418	Power Electronics	3
EECE-421	Power Systems Analysis/Design	3
EECE-431	Linear Controls	3
EECE-454	Communication Electronics	3
EECE-460	Wireless Communication	3
EECE-463	Digital Electronics	3
EECE-465	Physical Electronics	3
EECE-471	Design of Integrated Circuits	3
EECE-487	Telecommunications	3
EECE-496	IC Tech Lab	3

II. Social Science Elective Courses (3 hours required)

The list is not comprehensive or exhaustive; these courses have been historically offered but may not be available regularly. Please talk to your academic advisor before making a selection.

AFRO-005	Introduction to Afro-American Studies I	3
AFRO-006	Afro-American Studies II	3
AFRO-122	Education in Black America	3
AFRO-133	19th Century Black Social-Political	3
AFRO-186	Black Women in American II	3
AFST-101	Intro to Contemporary Africa	3
AFST-106	HIV/AIDS in Africa	3
ANTH-110	Intro to Cultural Anthropology	3
CLAS-115	Slavery in the Ancient World	3
ECON-001	Principles of Economics I (required)	3
ECON-002	Principles of Economics II	3
ECON-199	Intro to Urban Economics	3
HIST-003	Intro to History	3
HIST-005	Introduction to Black Diaspora I	3
HIST-006	Intro to Black Diaspora II	3
HIST-009	U.S. History to 1877	3
HIST-010	U.S. History since 1877	3
HIST-030	Intro to African History I	3
HIST-031	Intro to African History II	3
HIST-051	Intro to European History II	3
HIST-054	Intro to England	3
HIST-060	Intro to East Asian Civilization I	3
HIST-061	Intro to East Asian Civilization II	3
HIST-101	World Geography	3
HIST-106	Environmental Conservation	3
HIST-150	Intro to European History I	3
POLS-001	Introduction to Political Science	3
POLS-003	Intro to Comparative Politics	3
POLS-010	National Government of the U.S.	3
POLS-011	State and Local Government	3
SOCI-001	Introduction to Sociology	3
SOCI-174	Police, Law and Society	3
SOCI-198	Negro in America	3

III. Humanities Elective Courses (3 hours required)

Humanities Electives (per COAS Divisional Studies A)

The list is not comprehensive or exhaustive; these courses have been historically offered but may not be available regularly. Please talk to your academic advisor before making a selection.

ARTH-161	Art Appreciation	3
ARTH-164	Survey of Visual Art	3
CLAS-014	Intro to Humanities I	3
CLAS-016	Ideas in Antiquity	3
CLAS-050	Ancient Egypt and Near East	3
CLAS-103	Classical Art	3
ENGL-014	Intro to Humanities I	3
ENGL-015	Intro to Humanities II	3
ENGL-054	Afro-Am Literature to 1940	3
ENGL-055	Afro-Am Literature since 1940	3
FASH-102	African American Dress	3
FREN-014	Intro to Humanities I	3
FREN-106	African Films	3
HUMA-107	Women in Literature	3
MUSC-100	Introduction to Music	3
PHIL-055	Intro to Philosophy	3
RUSS-101	Literature in Revolution	3
RUSS-103	Love and Hate in Literature	3
SPAN-014	Intro to Humanities I	3
THFD-010	Introduction to the Theatre	3
THFD-080	Play Analysis	3

IV. African American Studies Elective Courses (3 hours required)

The list is not comprehensive or exhaustive; these courses have been historically offered but may not be available regularly. Please talk to your academic advisor before making a selection.

AFRO-005	Introduction to Afro-American Studies I	3
AFST-101	African World: Intro to Contemporary Africa	3
ARTH-193	Black Body Dress & Culture	3
ENGL-054	Afro-American Literature to 1940	3
FASH-102	African-American Dress	3
HIST-005	Introduction to Black Diaspora I	3
MUTP-100	Blacks in the Arts	3
POLS-006	Pan Africanism	3

V. Math/Science Elective Courses (3 credit hours required)

The list is not comprehensive or exhaustive; these courses have been historically offered but may not be available regularly. Please talk to your academic advisor before making a selection.

BIOL-101	General Biology I Lecture/Lab	3
BIOL-102	General Biology II Lecture/Lab	3
COMP-001	Life Sciences Lecture/Lab	3
COMP-002	Planetary Sciences Lecture/Lab	3
COMP-003	Physical Sciences Lecture/Lab	3
MATH-014	Intro to Data Science	3
MATH-026	Applied Calculus	3
MATH-009	Introduction Statistics	3
PHYS-001	General Physics Lecture/Lab	3
PHYS-002	General Physics Lecture/Lab	3
PHYS-010	General Astronomy I	3
PSYC-050	Introduction to Psychology (not for Psych majors)	3

C CpE PROGRAM 4-YEAR PLAN WITH PRE/CO-REQUISITES

Core courses are mainly offered only once per academic year. If you do not meet the minimum grade requirement, you must wait until the following year to retake the course.

Freshman Semester I

Course	Prerequisite	Co-requisite
MATH-156 Calculus I	MATH 007 or Math Placement Score	
EGPP-101 Intro to Engineering		
CSCI-135 Computer Science I		
CHEM-003 General Chemistry I Lecture		CHEM 005
CHEM-005 General Chemistry I Lab		

Freshman Semester II

Course	Prerequisite	Co-requisite
MATH-157 Calculus II	MATH-156	PHYS 013
EECE-102 Intro to EE & CpE		
EECE-260 Eng Prog and App		
PHYS-013 Phys for Sc & Engrs I[1]	MATH 156	MATH 156, PHYS-023
PHYS-023 Phys for Sc & Engrs I Lab		
MATH-181 Discrete Structures	MATH 156	

Sophomore Semester I

Course	Prerequisite	Co-requisite
MATH-158 Calculus III	MATH-157	
PHYS-014 Phys for Sc& Engrs II[2]	PHYS 013, MATH-157	MATH-157, PHYS-024
PHYS-024 Phys for Sc & Engrs II Lab		
EECE-212 Fund Digital Sys		EECE 218
EECE-218 Fund Digital Sys Lab		EECE 212
MATH-159 Differential Equations	MATH 157	

Sophomore Semester II

Course	Prerequisite	Co-requisite
EECE-160 Engineering Mathematics	MATH 158	
EECE-203 Fund Circuit Theory	PHYS-014, PHYS-024	EECE 209
EECE-209 Fund Circuit Theory Lab	PHYS-014, PHYS-024	EECE 203
EECE-406 Adv Dig Systems Design	EECE-212	EECE-412
EECE-412 Adv Dig Sys Design Lab		EECE 406

[1]MATH 156 may be taken as either a prerequisite or a corequisite for PHYS 013.
[2]MATH 157 may be taken as either a prerequisite or a corequisite for PHYS 014.

Junior Semester I

Course	Prerequisite	Co-requisite
EECE-305 Fund Electromagnetics	MATH-158	EECE 306
EECE-306 Fund Electromagnetics Lab		EECE 305
EECE-309 Fund Electronics and SS Devices	EECE 203	EECE 312
EECE-312 Fund Electronics and SS Dev Lab	EECE 209	EECE 309
EECE-331 Prob and Stat for Eng Appl	MATH 157	
ENGW-104(or ENGW-102) Writing, Literacy & Discourse (or Expository Wrtg & Literacy Stu)	English Placement Score or ACTE/SATW	

Junior Semester II

Course	Prerequisite	Co-requisite
EECE-333 Fund Signals and Systems	MATH 158	
EECE-417 Computer System Architecture		
Social Sciences Elective		
Afro-American Elective		
ENGW-105(or ENGW-103) Reflective Writing Portfolio (or Persuasive Writing & Research)	"C" or better in ENGW-104(or ENGW-102)	

Senior Semester I

Course	Prerequisite	Co-requisite
EECE-401 Senior Design I	Senior standing with instructor approval	
EECE-410 Intro to Computer Networks		
EECE-420 Introduction to VLSI Design	EECE 212, EECE 203	
EECE-424 VLSI Lab		EECE 420
EECE-416 Microcomputer Design	EECE 212	

Senior Semester II

Course	Prerequisite	Co-requisite
EECE-404 Senior Design II	EECE-401	
ECON-001 Principle of Economics		
EECE-4XX CpE Elective Course		
Math/Science Elective Course		
Humanities		

III. CpE COURSE DESCRIPTIONS

The following course description will also appear on the department web site and the course catalogue.

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

EECE-101/201/302 VIP: Faculty-Student Team Project **1 Credit**
The Vertically-Integrated Projects (VIP) Program operates in a research and development context. Undergraduate students that join VIP teams earn academic credit for their participation in design/discovery efforts in doing faculty-student team project. The enrolled students join and participate in their desired projects advised by respective faculty members. The instructor of the course acts as the coordinator of the VIP course for the entire VIP projects given by faculty advisors. Accumulation of 3 VIP courses with passing grade would satisfy one (1) EE/CpE Elective course requirement in the respective curriculum. Only one VIP course may be taken for a given semester.
Course Offering: FALL and SPRING.

EECE-102 Introduction to Electrical & Computer Engineering **1 Credit**
Continuation of EGPP-101 as related to the electrical engineering profession. Organized in five (5) Blocks: Descriptive, Environment, Technical, Practical (Hands on), and Projects, students are introduced to various engineering issues related to the profession of electrical engineering. Historical perspectives and Electrical Engineering Education / Profession and Design are reviewed. Ethics, social / environmental / cultural / religion issues facing electrical engineers in a global work environment are discussed. An overview of electrical engineering discipline and five major classifications of electrical systems in communication, computer, control, power, and signal processing is presented. Technical aspects and safety considerations of a typical electrical engineering laboratory are introduced. A capstone term project requires assembling an electrical system (e.g., a robot kit) and its study and presentation from a system point of view.
Course Offering: SPRING.

EECE-160 Engineering Mathematics **4 Credits**
Course introduction; history and importance of engineering Mathematics, trigonometry in engineering, 2-D vectors in engineering, complex numbers in engineering, 3-D vectors in engineering, systems of equations in engineering, application of derivatives in engineering, application of integrals in engineering, solving differential equation, applications of differential equations in engineering, Laplace transforms and applications, Interdisciplinary Applications.
Prereqs.: MATH-158. Course Offering: SPRING

EECE-203 Fundamental Circuit Theory **4 Credits**
Understanding of basic circuit theory, circuit theorems, dc, ac circuits, magnetic circuits, transients, Laplace and Fourier transforms, Fourier series, electric devices, 2-port network, basic filters and op-amps. Prereqs.: PHYS-014, PHYS-024.
Coreq.: EECE-209. Course Offering: SPRING.

EECE-209 Fundamental Circuit Theory Laboratory **1 Credit**
Understanding of hands-on labs associated basic circuit theory, circuit theorems, dc, ac circuits, operational amplifiers (op-amps), electric devices network, basic filters and op-amps.
Prereqs.: PHYS-014, PHYS-024. Coreq.: EECE-203. Course Offering: SPRING.

EECE-212 Fundamental Digital Systems **4 Credits**
Introduction to hardware building blocks used in digital computers and systems. Introduces number systems (including binary, octal and hexadecimal), Boolean algebra, two-level/multilevel logic minimization/simplification using K-Maps and Quine-McCluskey Methods, combinational logic circuit design and implementation with available SSI, MSI, and programmable logic devices (PAL, PLA, multiplexers, encoders, ROMS). Practical considerations such as Hazard and glitches are treated. Basics of sequential logic design including latches, flip-flops, registers, counters, finite state machines design, minimization, and implementation are presented.
Coreq: EECE-218. Course Offering: FALL.

EECE-218 Fundamental Digital Systems Laboratory **1 Credit**
Laboratory experiments and (mini) projects in design and implementation of simplex to moderately complex combinational and sequential logic circuits provide a practical understanding of concepts covered in EECE-212. Project(s) introduce students to design with programmable logic devices and logic design/simulation software such as Electronics Workbench.
Coreq: EECE-212. Course Offering: FALL.

EECE-260 Engineering Programming and Application **3 Credits**
The course covers both procedural programming and object-oriented programming in Python with applications to mathematics, numerical calculus, probability and statistics, physics, and differential calculus. It also covers basic C++ programming.
Course Offering: Spring.

EECE-305 Fundamental Electromagnetics **4 Credits**
Electric fields, flux and potential; Coulomb's Poisson's and Gauss's laws; permitivity and conductivity, magnetostatics, magnetic materials, magnetic materials and forces, Biot-Savart's law and time varying fields, Maxwell's equations in integral and differential forms, time-domain analysis of waves. Application of electromagnetic theory to Transmission lines.
Prereqs. MATH-158. Coreq: EECE-306. Course Offering: FALL.

EECE-306 Fundamental Electromagnetics Laboratory **1 Credit**
Fundamental applications of electromagnetic theory and developing modeling and simulation abilities. Topics include vector calculation and coulomb's law; vector representations in different coordinate systems; numerical calculation of electrostatic fields; Gauss's law and electrostatic potential; electrostatic boundary value problems; Poisson solver in MATLAB; cross product and Biot-Savart's law; symbolic programming in MATLAB; visualization of magnetic flux and calculation of magnetic force; fundamentals of dynamic electromagnetic fields; 3D visualization of electromagnetic wave; and solution of wave equation.
Coreq.: EECE-305. Course Offering: FALL.

EECE-309 Fundamental Electronics and Solid States **4 Credits**
Understanding of basic semiconductors devices, characteristics, switching and basic amplifiers, operational amplifiers, frequency response, filters, wave generation, introduction to power electronics,

team work.
Prereq.: EECE-203, Coreq: EECE-312. Course Offering: FALL.

EECE-312 Fundamental Electronics and Solid States Laboratory 1 Credit
Understanding of basic semiconductors devices, characteristics, switching and basic amplifiers, operational amplifiers, frequency response, filters, wave generation, introduction to power electronics, team work.
Prereqs.: EECE-209. Coreq: EECE-309. Course Offering: FALL.

EECE-325 Fundamentals of Energy Systems 4 Credits
This course focuses on the fundamentals of energy systems centered around electric power generation. Starting with the traditional system of large, central power stations connected to their customers by hundreds or thousands of miles of transmission lines, this course covers distributed, renewable, cleaner, smaller generation systems located closer to their loads. In that regard, while other generation sources such as Biomass and Fuel Cells are covered, wind power generation systems and photovoltaic (PV) power generation systems are highlighted in the course.
Prereq.: EECE-203, Coreq: EECE-326. Course Offering: SPRING.

EECE-326 Fundamentals of Energy Systems Laboratory 1 Credit
This course focuses on the laboratory experiments of fundamentals of energy systems dealing with poly-phase power measurements, synchronous machines, transmission line, renewable electricity systems of induction motor/generator. Also emphasized is renewable energy system modeling tools and system development using the modeling tools.
Coreq.: EECE-325. Course Offering: SPRING.

EECE-331 Probability and Statistics for Engineering Applications 3 Credits
Applications of signals and systems control, to communications and signal processing, (digital filter, narrow-band signals, modulation/demodulation, multiplexing: control systems, feedback and stability), computer exercises. Applied probability and statistics, sample spaces and events, measure theory, experiments, trials, distributions (such as Poisson, Bionomial, and normal), random variables (continuous and discrete), law of large numbers, Chebyshev's inequality, estimation, reliability and quality. Designing with tolerance, applications of probability and statistics in engineering design.
Prereq.: MATH-157. Course Offering: FALL.

EECE-333 Fundamental Signals and Systems 4 Credits
Design-based course, introduces comprehensive treatment of basic signal theory in time and frequency domains. Discrete and continuous time cases are treated simultaneously, covers concepts of signals and systems, convolution of difference and differential systems, block diagrams, state-space realizations and solution, matrix theory, Fourier series, transform techniques (Fourier, FFT, Z and Laplace), frequency response and stability. Exercises include traditional homework problems, computer applications such as MATLAB, C and SIGSYS and hardware design (laboratory generation of various signals and application to systems response) and design projects (Demonstration is required).
Prereqs: MATH-158. Course Offering: SPRING.

EECE-401 Senior Design I 3 Credits
Fundamentals of design principles, and engineering applications, design methodologies with emphasis on synthesis and evaluation, design process, reliability, the impact of engineering economy,

report writing, ethics and alternative solutions will be discussed.
Prereqs.: Senior Standing with Instructor Approval. Course Offering: FALL. NOTE: At the conclusion of this course, students must identify a topic and an advisor for their Thesis Design Project. The project must be approved by the advisor; this is a prerequisite for EECE-404.

EECE-404 Senior Design II **3 Credits**
To enhance knowledge of engineering design principles to solve real world problems, project planning, analysis, simulation and presentation, economic impact, ethics synthesis. Design areas are selected from solid state electronics, digital systems, communications (signal processing), power/energy systems and controls, power electronics, antennas and microwave and others. Oral presentation (with poster session) as well as written report required.
Prereq.: EECE-401. Course Offering: SPRING. NOTE: The entire semester will be devoted to the design and implementation of the Senior Thesis Project selected by students and approved by his/her advisor at the conclusion of EECE-401. It is the prerequisite of this course that students identify a topic and an advisor for their Senior Thesis Design Project at the conclusion of EECE-401.

EECE-406 Advanced Digital Systems Design **3 Credits**
Consists of design, analysis, optimization, and implementation of complex sequential digital systems and finite state machines (FSM). Hardware description languages (HDL), VHDL and/or Verilog, are introduced and will be used to design and implement digital systems. The structure of a computer and its organization will be reviewed. Finite state machine of a Simple Computer CPU will be developed and various implementation alternatives (FSM, time state, jump counters, and microprogramming) of its controller will be studied.
Prereq.: EECE-212. Coreq.: EECE-412. Course Offering: FALL.

EECE-408 Linear Control Systems **3 Credits**
Analysis of time and frequency response of closed loop systems, block diagrams, signal flow graphs, Mason gain, Routh-Hurwitz and Nyquist criteria for stability, root-locus method and system specifications, compensators, state variable methods, introduction to digital control.
Prereq.: EECE-333. Course Offering: FALL.

EECE-410 Intro to Computer Networks **3 Credits**
List of topics covered: Computer Networks and the Internet, Application Layer, Transport Layer, The Network Layer, The Data Link Layer, and The Physical Layer. More specifically, An Introduction to Networking, Networking Standards and the OSI Model, Transmission Basics and Networking Media, Introduction to TCP/IP Protocols.
Course Offering: FALL and SPRING.

EECE-412 Advanced Digital Systems Design Laboratory **1 Credit**
This lab course gives instructions on design, test, and verification, using VHSIC Hardware Description Language (VHDL) and associated CAD tools. Brief list of topics to be covered: VDHL syntax and good practices, VHDL behavioral and structural descriptions, Finite State Machines (FSM)/Data Paths/Control Paths, etc.
Coreq.: EECE-406. Course Offering: FALL.

EECE-416 Microcomputer Design **3 Credits**
Examines microprocessors, support architectures, and hardware/software. Microprocessors' soft-

ware model and programming, assembly language programming, microprocessor applications, microprocessor based systems, and microcomputers. Projects will be used to introduce microprocessor applications.
Prereq.: EECE-212. Course Offering: FALL.

EECE-417 Computer Architecture **3 Credits**
Computer Abstractions and Technology, Instructions: Language of the Computer, Arithmetic for Computers, The RISC-V Processor, Large and Fast: Exploiting Memory Hierarchy, Parallel Processors from Client to Cloud
Prereq.: EECE-212. Course Offering: SPRING.

EECE-418 Power Electronics **3 Credits**
Characteristics of power electronics devices, converters, ac-dc, dc-dc, ac-ac, dc-ac, power supplies, cycloconverters, design projects, computer simulations.
Prereqs.: EECE-203. Course Offering: FALL.

EECE-419 Motor Dynamics and Drives **3 Credits**
D.C. and A.C. drives, electric motors, microcomputer control, protective relaying, projects, computer simulations.
Prereqs.: EECE-325, and EECE-418. Course Offering: FALL

EECE-420 Introduction to VLSI Design **3 Credits**
CMOS technology and theory; CMOS circuit and digital logic design; layout rules and techniques; circuit characterization and performance estimation; CMOS subsystem design; VLSI systems design methods; VLSI CAD tools; laboratory experience in custom VLSI chip design on workstations using concepts in cell hierarchy; final project involving specification, design and evaluation of a VLSI chip or VLSI CAD program. Written report and oral presentation of the final project are required.
Prereqs.: EECE-212, and EECE-309. Course Offering: FALL

EECE-423 VLSI Lab **1 Credits**
Chip fabrication is highly expensive and time-consuming. Because of this, designers rely on simulation tools to explore design spaces and verify layouts before manufacturing. While simulators operate across multiple levels of abstraction—from physical processes to system architecture—this lab focuses specifically on circuit simulation using Synopsys HSPICE. Key topics covered include *HSPICE Fundamentals*: Learn the core basics and commands of the software. *Gate Characterization*: Analyze standard CMOS gates, including NOT and NAND structures. *Circuit Analysis*: Evaluate propagation delay and power consumption in fundamental circuits.
Coreq.: EECE-420. Course Offering: FALL

EECE-421 Power Systems Analysis **3 Credits**
Covers one-line diagram per unit quantity, power generation and synchronous machines, transmission line theory, analysis of interconnected systems using load flow studies and computation techniques. Economic operation of power system. Design Projects.
Prereq.: EECE-325. Course Offering: FALL.

EECE-422 Power Communications & Control **3 Credits**
Continuation of EECE-421. Introduction to Telecommunication, Fundamentals of Communications, Data Representation and Communication, Power System and Fault Analysis, Protection and

Controls, Power System Stability, Communication Protocol Concepts and Security and Standards.
Prereq.: EECE-421. Course Offering: SPRING.

EECE-443 Introduction to Microwaves **3 Credits**
Electromagnetic wave propagation, microwave transmission systems, tube and solid-state microwave devices, and waveguides. Time-domain reflections, matching, Smith chart, S-parameters analysis, active and passive microwave components. Microwave measurement techniques.
Prereq.: EECE-305. Course Offering: SPRING.

EECE-444 Antenna Theory and Practice **3 Credits**
Antenna parameters; polarization of electromagnetic waves; basic antenna types; antenna arrays; broadband antenna design. Electrically small wire type apertures antenna design, measurements and simulation using Matlab or Mathcad.
Prereq.: EECE-305. Course Offering: SPRING

EECE-446 ASIC Design **3 Credits**

Course Offering:

EECE-453 Communications Theory **3 Credits**
Includes probability theory, hypothesis testing, channel capacity, coding, detection and system performance analysis.
Prereq.: EECE-331 or EECE-333. Course Offering: FALL.

EECE-454 Communication Electronics **3 Credits**
Spectrum and noise measurements. Analog and digital communication techniques. Design of AM and ASK detectors, FM and FSK modulators and phase lock loops.
Prereq.: EECE-309. Course Offering: SPRING.

EECE-456 Embedded Systems Design Lab **3 Credits**
Project based course for design and system integration of embedded systems using microprocessor boards and I/O devices.
Prereq: EECE-416. Course Offering: SPRING.

EECE-459 Communications Theory Lab **1 Credit**
Design of modulation and demodulation circuits, filters.
Coreq: EECE-453. Course Offering: FALL.

EECE-460 Wireless Communication **3 Credits**
The physical layer of wireless communication systems. Implementation of speech coding, error control, modulation/demodulation and filtering schemes for wireless links using digital signal processors for baseband functions.
Prereqs.: EECE-453. Course Offering: SPRING

EECE-461 Solid State Electronics I **3 Credits**
Semiconductor properties, valence bands, energy bands, equilibrium distribution of electrons and non-equilibrium transport of charges, Breakdown mechanisms; essential features of small ac characteristics, switching and transient behavior of p-n junctions.
Prereq.: EECE-309. Course Offering: SPRING

EECE-462 Solid State Electronics II **3 Credits**
Semiconductor electronic properties and applications to electronic devices; Tunnel and Zener diodes, point contact transistors, FETs, MOSFETS, BJTS, multi junction devices, and small, medium and large scale integrated circuits.
Prereq.: EECE-461. Course Offering: FALL

EECE-463 Digital Electronics **3 Credits**
Bipolar and MOS field effect transistor characterization; characteristics and applications of TTL integrated circuits, design of memories, digital processors, special computer architecture, interfaces and A/D and D/A converters.
Prereqs.: EECE-309. Course Offering: SPRING

EECE-465 Physical Electronics **3 Credits**
Analysis of semiconductor device characteristics, junction breakdown, base-width modulation and capacitive effects. Model derivations from physical considerations.
Prereqs.: PHYS-014 and EECE-309. Course Offering: SPRING

EECE-466 Advanced Electromagnetic Theory **3 Credits**
Propagation of electromagnetic waves in general waveguides, losses in waveguides, fields and matter interaction, electromagnetic theory and special relativity, ionospheric propagation.
Prereq. EECE-305. Course Offering: SPRING.

EECE-471 Design of Integrated Circuits **3 Credits**
Microelectronics and circuit design. In depth coverage of Silicon integrated device characteristics and fabrication.
Prereqs.: EECE-309. Course Offering: FALL.

EECE-477 Design of Integrated Circuits Lab **3 Credits**
In depth theoretical and experimental microelectronics through hands-on circuit design and testing. Detailed coverage of Silicon integrated device characteristics and fabrication.
Prereq.: EECE-471. Course Offering: SPRING.

EECE-479 Cybersecurity for Net CPS/IoT **3 Credits**
This course is designed to introduce emerging topics related to cybersecurity challenges and practical cyber-defense/countermeasures in networked Cyber-Physical Systems (CPS) and Internet-of-Things (IoT). The course will cover fundamental concepts, technologies, theoretical understanding and practical basis for cybersecurity of networked CPS/IoT. Graduate students will complete an independent research project which involves a written and oral presentation not required at the undergraduate level.
Course Offering: FALL.

EECE-481 Advanced Integrated Circuit Design **3 Credits**
This course focuses on the design and implementation of a moderate-sized digital, analog, or mixed-signal integrated circuit using modern semiconductor technologies and industry-standard EDA tools. Topics include system specification, chip design, design-for-testability, floorplanning, and full-chip integration and verification. Students gain hands-on experience with the complete IC design flow from concept through GDSII generation and tapeout, while evaluating key design metrics such as area, speed, and power.
Course Offering: SPRING.

EECE-482 Integrated Circuit Validation **3 Credits**
This course builds on Advanced Integrated Circuit Design and focuses on the post-silicon validation and verification of fabricated integrated circuits. Topics include silicon bring-up, test development, debugging methodologies, and performance characterization. Students gain practical experience in evaluating fabricated chips, identifying design and implementation issues, and applying industry-standard validation and debugging techniques.
Course Offering: FALL.

EECE-487 Telecommunications **3 Credits**
Consists of telecommunications systems design for point-to-point and mass data distribution, modulation techniques, propagation modes and control methods.
Prereq.: EECE-453. Course Offering: SPRING

EECE-495 Signal Processing **3 Credits**
Sampling as a modulation process; aliasing; the sampling theorem; the Z-transform and discrete-time system analysis; direct and computer-aided design of recursive and non recursive digital filters; the Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT); digital filtering using the FFT; analog-to-digital and digital-to-analog conversion; effects of quantization and finite-word-length arithmetic, and design and implementation of these algorithms on Motorola family of Digital Signal Processor chips and/or other similar DSP chips.
Prereq.: EECE-333. Course Offering: FALL

EECE-498 Independent Project **3 Credits**
Study performed by individual student under faculty supervision.
Prereq.: Departmental approval. Course Offering: FALL/SPRING.

EECE-496 Integrated Circuits Tech Lab **3 Credits**
This laboratory course is to serve as a hands-on introduction to the environment, processes, and procedures that can be used in the processing of semiconductor materials, and fabrication of nanostructures. Processes that will be performed include lithography, metallization, materials characterization, etc. The evaluation procedures associated with each process will also be examined. Students will process semiconductor wafers resulting in the formation of actual device structures.

EECE-499 Special Topics in Electrical Engineering **3 Credits**
Special courses not offered on a regular basis. Prereq.: Departmental approval.
Course Offering: FALL/SPRING.

IV. EECS FACULTY

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V. CODE OF ETHICS OF ENGINEERS

The Fundamental Principles

Engineers uphold and advance the integrity, honor and dignity of the engineering profession by:

- using their knowledge and skills for the enhancement of human welfare;
- being honest and impartial, and serving with fidelity the public, their employers and clients;
- striving to increase the competence and prestige of the engineering profession; and
- supporting the professional technical societies of their disciplines.

The Fundamental Canons

1. Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties.
2. Engineers shall perform services only in the areas of their competence.
3. Engineers shall issue public statements only in an objective and truthful manner.
4. Engineers shall act in professional manners for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.
5. Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
6. Engineers shall act in such manner as to uphold and enhance the honor, integrity and dignity of the profession.
7. Engineers shall continue their professional development throughout their careers and shall provide opportunities for the professional development of those engineers under their supervision.

VI. POLICY ON EQUAL OPPORTUNITY

The mission of Howard University includes the provision of quality education for any student, but with emphasis upon the provision of educational opportunities for those students who may not otherwise have an opportunity to acquire an education of the type provided at Howard. In fulfilling its mission, the university does not discriminate on the basis of race, color, national and ethnic origin, sex, marital status, religion, or handicap in the administration of its educational policies, admissions policies, scholarship and loan programs, and other University administered programs and employment.

Howard University is committed to equal opportunity in all aspects of its relations with faculty, students, and staff members without regard to race, color, national and ethnic origin, sex, marital status, religion, age or handicap. The requirement not to discriminate in education programs and activities extends to employment therein and admission thereto.

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Charles Kim, Ph.D.
Interim Chair and Professor