

Course Descriptions For Courses In College of Engineering Degrees

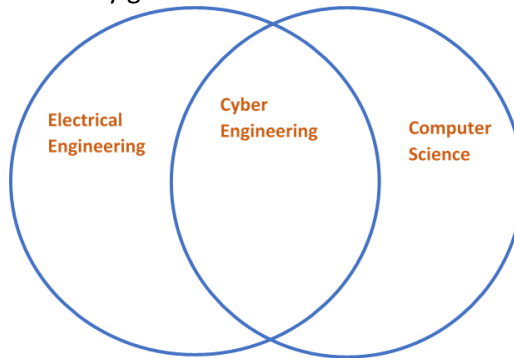
Key Characteristics:

Curricular threads are broad themes or topics that appear in many if not all courses in a curricular sequence. These themes will appear to some degree in all three of the HBU College of Engineering programs. Potential curricular threads include Cybersecurity, Cloud Computing (storage, access, security), Mobility (wireless networks, mobile devices, Internet of Things), Data Analytics (Big Data), and Project Management.

All students in the College of Engineering will complete a **year-long senior project**, directed by faculty but sponsored by industrial partners. In addition, all students will complete at least one professional education experience (i.e. **internship**). HBU staff will assist students in identifying internship opportunities.

A course numbering convention is proposed where each course is assigned a four digit reference number. The first digit identifies the level of the course (1 = first year, 2 = second year, 3 = third year, 4 = fourth and final year of undergraduate study). The second digit identifies the number of semester credit hours. The third digit identifies a category of courses by general content areas:

- 10 = Project and Professional Experience
- 20 = Fundamental Knowledge
- 30 = Cyber Security
- 40 = Computer/Network Systems
- 50 = Programming/Software/Computing
- 60 = Electrical Circuits and Electronics
- 70 = Controls/Instrumentation
- 80 = Analytics



The figure demonstrates the relationships among the three engineering disciplines.

MATH AND SCIENCE REQUIREMENTS

MATH 1034 Precalculus Mathematics Laboratory

Prerequisite(s): MATH 1313 and MATH 1323 or a satisfactory score on a departmental placement exam

Corequisite(s): MATH 1434

This is the laboratory portion of MATH 1434

MATH 1051 Calculus I Laboratory

Prerequisite(s): MATH 1434 or a satisfactory score on a departmental placement exam

Corequisite(s): MATH 1451

This is the laboratory portion of MATH 1451, Calculus I.

MATH 1052 Calculus II Laboratory

Prerequisite(s): MATH 1451; Corequisite(s): MATH 1452

This is the laboratory portion of MATH 1452, Calculus II.

MATH 1434 Precalculus Mathematics

Prerequisite(s): MATH 1323 or a satisfactory score on a HBU required math placement exam

Corequisite(s): MATH 1034

Sets, relations, functions, roots of polynomial equations, trigonometry, and analytic geometry. This course may not be counted as part of the mathematics major. This course includes one semester hour credit for laboratory sessions.

MATH 1451 Calculus I

Prerequisite(s): MATH 1434 or a satisfactory score on a HBU required math placement test

Corequisite(s): MATH 1051

Limits, continuity, differentiation and integration of elementary and transcendental functions, L'Hopital's Rule. Applications, including rates of change, max/min problems, and area between curves. This course includes one semester hour credit for laboratory sessions.

MATH 1452 Calculus II

Prerequisite(s): MATH 1451; Corequisite(s): MATH 1052

A continuation of MATH 1451. Topics include: Techniques and applications of integration, improper integrals, parametric representations of curves, polar coordinates, L'Hopital's Rule, numerical approximation of integrals, an introduction to differential equations, and infinite series. This course includes one semester hour credit for laboratory sessions.

MATH 2023 Linear Algebra Laboratory

Prerequisite(s): MATH 1451; Corequisite(s): MATH 2423

This is the laboratory portion of MATH 2423, Linear Algebra.

MATH 2051 Calculus III Laboratory

Prerequisite(s): MATH 1452; Corequisite(s): MATH 2451

This is the laboratory portion of MATH 2451, Calculus III.

MATH 2323 Linear Algebra

Prerequisite(s): MATH 1451

Introduction to linearity in mathematics. Topics include: matrices, determinants, abstract vector spaces, linear dependence, bases, eigenvalues and eigenvectors, and linear transformations.

MATH 2451 Calculus III

Prerequisite(s): MATH 1452; Corequisite(s): MATH 2051

A continuation of MATH 1452. Topics include: three-dimensional coordinate systems, quadric surfaces, cylindrical and spherical coordinates, vector calculus in three dimensions, partial derivatives, the total differential, multiple integrals, line integrals, surface integrals, vector fields, Green's Theorem, Stokes' Theorem, the Divergence Theorem, and applications. This course includes one semester hour credit for laboratory sessions.

MATH 3333 Ordinary Differential Equations

Prerequisite(s): MATH 1452 and MATH 2323

A first course. Topics include: existence and uniqueness of solutions, solutions of linear equations, solutions of higher order linear equations with constant coefficients, infinite series solutions, numerical solutions, solutions of linear systems, an introduction to nonlinear differential equations, and application.

MATH 3311 Introduction to Discrete Mathematics and Combinatorics

Prerequisite(s): MATH 1451.

This course introduces students to elements of combinatorics, number theory, and discrete structures. Topics covered include: permutations, combinations, prime factorizations, the Euclidean Algorithm, relations, the pigeonhole principles, inclusion and exclusion, and finite state machines. It exposes students to areas of mathematics of current practical interest and involves the use of proof and algorithmic thinking.

PHYS 2413 Principles of Physics I

Prerequisite(s): MATH 1451

An introduction to Newton's laws of motion, gravitation, fluids, and sound. This course includes one semester hour credit for laboratory sessions.

PHYS 2423 Principles of Physics II

Prerequisite(s): PHYS 2413

An introduction to the physical principles of thermodynamics, kinetic theory, electricity, magnetism, simple AC and DC circuits, and geometric wave optics. This course includes one semester hour credit for laboratory sessions.

ENGINEERING AND SCIENCE COURSES

ENSC 1411 Engineering and Cyber Projects I

Prerequisite(s): MATH 1323 or equivalent

An introduction to engineering profession, engineering design and problem-solving, computing, algorithms, programming and software structures, and computer systems.

ENSC 1412 Engineering and Cyber Projects II

Prerequisite(s): ENSC 1411, MATH 1434

Additional engineering and computing projects using electronic components, algorithms and programming, and applications

ENSC 2361 Electrical Engineering and Circuits

Prerequisite ENSC 1412, MATH 1451

Fundamental concepts, units and laws. Network theorems, network simplification, phasors and AC solution of circuits, power and electronic applications.

ENSC 4311 Senior Project I

Prerequisite Instructor's Signature Required

Open-ended, team-based design project that draws on student's entire academic experience with emphasis on idea generation and conceptual design. Social and ethical aspects of engineering and computing. Communication skills.

ENSC 4312 Senior Project II

Prerequisite ENGR 4311 w/minimum grade of "C".

Continuation of ENSC 4311 with emphasis on implementation and testing.

ENSC 4315 Internship/Professional Experience

Prerequisite CONSENT OF DEAN

On-site, supervised, structured work experience. This course may be taken to facilitate a three month off-campus professional experience or part-time professional experience.

COMPUTER SCIENCE COURSES

COSC 1351 Introduction to Computer Programming

Prerequisite MATH 1323 or equivalent.

An overview of the field of computing, applications, algorithms, data structures, rudimentary programming, machine architecture, digital logic, history, impact, and current trends. Introductory programming using an objects-first approach. Problem analysis and solution. Introductory modeling and abstraction. Documentation, good programming practices. Data and control structures as needed.

COSC 1352 Intermediate Computer Programming

Prerequisite MATH 1434 or equivalent, COSC 1351

An introduction to computer programming using an objects first approach; problem solving; an overview of the field of computing. Analysis, design and implementation of programs. Application structures, algorithm development, event-driven programming, graphical user interfaces, exception handling, recursion.

COSC 2351 Data Structures

Prerequisite COSC 1352, MATH 1451

The definition, representation, and manipulation of basic data structures such as arrays, stacks, queues, trees, and graphs. Practical applications of these structures will be emphasized.

COSC 2352 Systems Programming

Prerequisite COSC 1352, MATH 1451

An introduction to systems programming within the context of C/C++ and Linux; topics include linking, writing scripts, performing system calls, managing memory, and using concurrency.

COSC 2353 Operating Systems

Prerequisite COSC 2352

An introduction to operating systems concepts. Topics include process management, storage management, device management, performance, security, and case studies of modern operating systems.

COSC 3341 Computer Architecture

Prerequisite COSC 2351

Architecture and organization of computer systems. Topics include the processor, control unit and microprogramming, computer arithmetic, memory hierarchy and memory management, input/output, instruction sets.

COSC 3342 Computer Networks

Prerequisite COSC 2353 or consent of instructor.

An overview of computer networks. Topics include network topologies, layers, local area networks, and performance measurement and analysis.

COSC 3351 Advanced Data Structures and Algorithms

Prerequisite COSC 2351 and Preq or Coreq of MATH 2323

Advanced data structures and algorithm design. Topics include specialized trees, graphs, sets and tables, advanced searching and sorting, complexity analysis, and algorithm design techniques.

COSC 3352 Theory of Computing

Prerequisite COSC 2351 and MATH 2323

An overview of formal languages, the abstract models of computing capable of recognizing those languages, and the grammars used to generate them.

COSC 3353 Programming Languages

Prerequisite COSC 3351.

Techniques for specifying the syntax and semantics of programming languages. Language concepts; execution environments, comparative analysis of programming languages.

COSC 4331: Introduction to Cyber Security

Prerequisite COSC 2353

Overview of cyber security; provides students with practical cyber security experience based on theoretical foundations. Topics include: computer network defense, computer network attack, wireless security.

CYBER ENGINEERING COURSES

CYEN 3331 Computer Network Security

Prerequisite COSC 2351

Overview of computer network security, broad coverage of cyber security concepts, computer network defense, computer network attack, and wireless security.

CYEN 4331 Digital Forensics and Cyber Crime

Prerequisite CYEN 3331

An overview of forensics including methods to uncover and exploit digital evidence; cyber crime, forensics analysis techniques.

CYEN 4332 Wireless and Mobile Security

Prerequisite CYEN 3331

Overview of wireless and mobile security providing students with practical and theoretical experiences. Topics include threat analysis, security infrastructure, security services, wireless network security components.

CYEN 4333 Reverse Engineering

Prerequisite CYEN 3331 or Consent of Instructor

Overview of reverse engineering techniques, modern tools for reverse engineering of machine code. Topics include gathering information, PE32 format, obfuscation techniques, memory dumping, automating processes.

CYEN 4335 Applied Cryptography

Prerequisite CYEN 3331 or Consent of Instructor

An introduction to the basic theory and practice of cryptographic techniques used in computer security. Topics include encryption, key management, hashing, network security protocols.

CYEN 4337 Security Operations

Prerequisite: CYEN 3331 or Consent of Instructor

Overview of security assessment, network operations, and security protocols.

CYEN 4351 Software Design and Engineering

Prerequisite COSC 2351

Design, construction and maintenance of large software systems. Project planning, requirements analysis, software design methodologies, software implementation and testing, maintenance.

CYEN 4352 Distributed and Cloud Computing

Prerequisite CSC 4351 or Consent of Instructor

Overview of distributed computing. Theoretical and applicable aspects of distributed systems and cloud computing. Modeling aspects including architecture, performance, reliability, availability, service models, security characteristics.

CYEN 4371 Access Control Logic and Covert Channels

Prerequisite CYEN 2351 AND MATH 3311

An overview of access control logic and covert channels. Topics include access control concepts and logic, covert channel detection, future security predictions, steganography, steganalysis, data hiding

CYEN 4381 Data Analytics

Prerequisite Consent of Instructor

Introduction to data analytics; key tools and concepts from the functional, technical, and implementation perspective of using data analytics to solve real world challenges.

CYEN 4391 Blockchain

Prerequisite: Prior background in Python within a Unix environment is recommended, but no previous Bitcoin knowledge is necessary.

The course covers all aspects of cryptocurrencies, including distributed consensus, blockchains, smart contracts and applications; focusing on Bitcoin and Ethereum as case studies.

ELECTRICAL ENGINEERING COURSES

ELEN 2325 Electrical and Magnetic Fields

Prerequisite PHYS 2423, ENSC 2361, MATH 2451.

Vector analysis, Coulomb's and Gauss' Law. Electric field streamlines. Energy and potential. Conductors, dielectrics, capacitance. Maxwell's, Poisson's and Laplace's equations. Steady magnetic fields. Joule's Law. Ampere's Circuit Law, magnetic flux and potential, magnetic forces, materials and inductance, time-varying electromagnetic fields, Maxwell's equations, plane waves, transmission lines, impedance-matching devices.

ELEN 2341 Introduction to Microprocessors & Digital Design

Prerequisite: ENSC 1452; Credit or registration in MATH 2451

Introduction to microprocessor organization and operation, data manipulation, assembly and/or embedded-C language programming, serial communication, analog-to-digital conversion, timers, interrupts, DC motor control. Digital design techniques, Boolean algebra, combinational logic, minimization techniques, simple arithmetic circuits, programmable logic, sequential circuit design, registers and counters, state machines, Verilog and VHDL.

ELEN 2362 Electrical Circuits II

Prerequisite ENSC 2361.

Steady-state and transient analysis of RL, RC and RLC circuits. Design problems using circuit analysis programs. Analysis of ideal and non-ideal operational amplifiers. Magnetically coupled circuits. Complex frequency. Two-port networks. Laplace transforms. Frequency response.

ELEN 3342 Digital Signal Processing

Prerequisite ELEN 3361

Discrete signals, LTI systems, discrete Fourier analysis, discrete filters, sampling, Z-transforms.

ELEN 3361 Linear Systems

Prerequisite ENSC 2361, MATH 2451.

Fourier Series, Fourier Transform, Laplace Transform. Convolution and the system function. Filters. State variable representation and solution.

ELEN 3362 Solid State Electronics

Prerequisite MATH 2451, PHYS 2423, and ENSC 2361

Fundamentals of solid state electronic materials and devices, emphasizing semiconductors and principles of operation of ULSI devices.

ELEN 3363 Electronic Circuits

Prerequisite ELEN 2351 and ELEN 3362

Circuit-level behavior of diodes, bipolar transistors, field-effect transistors, and operational amplifiers. Analysis and design of linear amplifiers. Frequency domain characterization of transistor circuits.

ELEN 4341 Embedded Systems

Prerequisite ELEN 2341

Assembly and C programming on a customizable microprocessor implemented on an FPGA board. Verilog components, RTOS, debugging techniques, state machines, software revision control, DSP programming.

ELEN 4371 Instrumentation and Measurement

Prerequisite ENCS 2361

Transducers, including 4-20 mA loops. Signal Conditioning. Industrial Control Electronics, including Programmable Logic Controllers (PLCs). Statistical analysis on experimental data.

ELEN 4372 Communication Systems

Prerequisite ELEN 3342

Analog and digital communication systems. Random signals, noise and filtering. Physical constraints. Multiplexing. Properties of AM, FM, PSK, and QAM systems

ELEN 4373 SCADA Systems

Prerequisite ELEN 2341, MATH 2451.

Analysis and design of linear feedback systems. Mathematical modeling. Transfer functions and signal-flow graphs. State variable analysis. Time domain analysis and design of linear control systems. Frequency domain analysis and design of linear control systems. Security of cyber physical systems.