Engineering (ENGN) Courses

ENGN1015 Introduction to Engineering
This first-year engineering course is designed as an introduction to engineering and the techniques and tools used in solving engineering problems. The engineering design process is utilized in the development of solutions to problems. Data analysis, formula construction and graphing techniques are developed through the use of software applications. Programming in MATLAB and Python are included. Individual as well as team problem-solving activities are required with written technical documentation. The nature of engineering ethics and professional responsibility are discussed and the impact of engineering solutions in a global, economic, environmental and societal context are addressed.
Offered at Providence
3 Semester Credits

ENGN2001 Digital Logic Design
This course focuses on the fundamental theory of combinational and sequential logic, including the analysis and design of digital circuits. Topics include numbering systems, logic gates, Boolean algebra, minimization of logic functions, timing diagrams, flip-flops, finite state diagrams, counters and registers. This course includes the use of FPGA software and tools for minimization, simulation, and schematic capture of combinational and sequential digital circuits.
Offered at Providence
4 Semester Credits

ENGN2009 C Programming for Engineering
This programming course teaches students the fundamental principles of programming and using the C programming language to solve engineering problems. Students are familiarized with the process of design and development of computer programs to solve engineering problems using standard strategies and techniques used in industry. Topics covered include how programs are structured, how arrays and strings are processed, and how files are manipulated. Students gain experience with industry-specific hardware to interface with their programs.
Prerequisite(s): ENGN1015.
Offered at Providence
4 Semester Credits

ENGN2014 Computer Architecture I
This course is a study of the evolution of computer architecture and the factors influencing the design of hardware and software elements of computer systems. Topics include instruction set design; processor micro-architecture and pipe-lining; cache and virtual memory organizations; scheduling, standard hardware performance metrics (e.g., processor speed, number of bits per processor, address capacity, number of interrupt vectors, etc.), protection and sharing; I/O and interrupts; VLIW machines; multi-threaded architectures; symmetric multiprocessors; and parallel computers.
Prerequisite(s): CSIS1112 (or concurrent).
Offered at Online, Providence
3 Semester Credits

ENGN2020 Transform Methods for Engineering
This course covers the time and frequency analysis of linear systems involving Fourier series, the Fourier and Laplace transforms. Transfer function analysis and synthesis principles are developed and placed into application settings. The role of the Laplace transform in network analysis including steady-state AC analysis is addressed. Equivalent state space models are developed.
Prerequisite(s): MATH2040.
Offered at Providence
3 Semester Credits

ENGN2025 Applied Mechanics I: Statics
This course is an introduction to the fundamental concepts of engineering mechanics. Topics include terminology, two and three dimensional force systems, determination of the resultant force of force systems, analysis of coplanar systems in equilibrium, centroids, and moments of inertia and friction.
Prerequisite(s): MATH1040 (or concurrent), ((PHY1011 and PHY1016) or (PHY2011 and PHY2016)).
Offered at Providence
3 Semester Credits

ENGN2035 Programmable Logic Controllers
This course is an introduction to programmable logic controllers (PLCs). It focuses on how PLCs perform process control and motor control functions. Topics include PLC architecture, working principles, programming techniques, ladder logic programming, data manipulation, data highway, and various input/output modules and their interface for actuation signal control.
Prerequisite(s): ENGN2101, ENGN2102.
Offered at Providence
3 Semester Credits

ENGN2045 Computer Vision
This course provides an introduction to the basic elements of computer vision. Emphasis is placed on the applications and practical aspects of computer vision as well as their mathematical formulations and theory. This course involves intensive hands-on computer lab work using modern programming languages and packages. Topics in the course focus on image formations, image processing, and feature detection.
Prerequisite(s): CSIS1020 or CSIS1101 or ENGN2009, MATH1030 (or higher).
Offered at Providence
3 Semester Credits

ENGN2062 Artificial Intelligence
This course introduces students to the basic concepts of artificial intelligence, including some applications. The course first introduces the different methods of representing knowledge and inference methods. It is then followed by the study of rule based expert system, fuzzy expert systems and artificial neural networks. There is also a brief introduction to the area of evolutionary computation and genetic programming. Basic method of shape recognition and classifiers may be discussed. Some probability theory and Bayesian analysis are also covered in the course.
Prerequisite(s): CSIS1020 or CSIS1101 or ENGN2009, MATH1030 (or higher).
Offered at Providence
3 Semester Credits

ENGN2085 Introduction to Embedded Systems
This is an introductory course in embedded systems, which is a project-oriented design course. Topics include embedded system architectures, memory systems and managements, sensors integrations, power managements, software development tools and platforms, and real-time operating systems.
Prerequisite(s): (ENGN2009 and ENGN2014) or (CSIS2023 and ENGN2014) or (CSIS2023 and CYB2010) or (ENGN2009 and ENGN2205 (or concurrent)).
Offered at Providence
3 Semester Credits

ENGN2101 Linear Circuit Theory
This course provides a firm foundation in DC and AC circuit analysis. Emphasis is upon the understanding and application of Ohm's law and Kirchhoff's Voltage and Current Laws in RC, RL and RLC circuits. Methods of linear systems analysis are introduced including Thevenin's and Norton's theorems and the superposition principle. The use of complex numbers and phasor analysis are used to analyze AC passive network circuits. The concepts of maximum power transfer, resonance and passive filters are also covered. Developing an ability to solve engineering problems to design, implement and test circuits to meet design specifications is a focus of the course.
Prerequisite(s): MATH1040 (or concurrent), Corequisite: ENGN2102.
Offered at Providence
3 Semester Credits

ENGN2102 Linear Circuit Theory Lab
The course includes laboratory project activities requiring design, simulation, implementation, measurement and testing of circuits to meet design specifications. Labs are designed to reinforce concepts discussed in ENGN2101 Linear Circuit Theory.
Prerequisite(s): MATH1040 (or concurrent), Corequisite: ENGN2101.
Offered at Providence
1 Semester Credit

ENGN2205 Microcontrollers
This course covers introductory and advanced topics in microcontrollers. Topics covered include microcontroller architecture, assembly instruction set, machine code, assembly and high level programming, subroutines, interrupts, basic microcontroller peripherals and co-processors. Various memory technologies and basic memory design for microcontrollers, the interdependence of hardware and software, input/output, and microcontroller applications development tools and platforms are studied.
Prerequisite(s): ENGN2001, ENGN2009.
Offered at Providence
3 Semester Credits

ENGN3000 Materials and Process Engineering
This course develops the general properties of materials, defined as plastic, ferrous, nonferrous and ceramics used in product development. Properties of materials are applied to industrial applications to achieve optimum designs. Process engineering concepts are developed from conversion of raw materials into finished products using manufacturing methods to optimize production of parts.
Offered at Providence
3 Semester Credits

ENGN3005 Operational Amplifiers and Linear Circuits
This course focuses on the characteristics and application of operational amplifiers (OpAmps) The principles of feedback, open and closed loop operation, and inverting and non-inverting operation of operational amplifiers are explored as is the linear and non-linear operation of the OpAmp. Applications utilizing op-amps including its use as an integrator, differentiator, comparator and active filters are also included. Laboratory projects, both hands-on and simulation, are integrated to reinforce the theory presented in lecture with practical applications to determine device/component performance and operating conditions.
Prerequisite(s): (ENGN2007 and ENGN2008) or (ENGN2101 and ENGN2102), MATH2040.
Offered at Providence
3 Semester Credits

ENGN3025 Applied Mechanics II: Dynamics
This course introduces the fundamental concepts in kinematics and dynamics that are necessary to understand and analyze mechanisms and machines. Newtonian mechanics including kinematics and kinetics principles of rigid-body dynamics are introduced. Emphasis is on the analysis of bodies in plane motion.
Prerequisite(s): ENGN2025, MATH1040 (or concurrent), ((PHY1011 and PHY1016) or (PHY2011 and PHY2016)).
Offered at Providence
3 Semester Credits

ENGN3045 Electricity & Magnetism
This course is a study of the laws of electromagnetism including electrostatics, magnetostatics and electrodynamics. Maxwell's equations and the mathematical foundations of vector analysis are presented. The course also covers the basic topics in electronic communication: basic principles of antenna, signal transmission and reception; methods of modulations (AM, FM, PM, including DSB and SSB); and spectrum analysis of each method.
Prerequisite(s): ENGN2101, ENGN2102, MATH2043, PHY2022, PHY2026.
Offered at Providence
3 Semester Credits

ENGN3053 Strength of Materials
Introduction to the fundamental principles of strength, stiffness, and stability as they apply to mechanical components.
Prerequisite(s): ENGN2025, MATH1040.
Offered at Providence
3 Semester Credits

ENGN3075 Applied Fluid Mechanics
This course studies compressible and incompressible fluid statics and dynamics as applied to hydraulic and pneumatic pumps, motors, transmissions and controls.
Prerequisite(s): MATH2040, ENGN3025, ((PHY1011 and PHY1016) or (PHY2011 and PHY2016)).
Offered at Providence
3 Semester Credits

ENGN3085 Principles of Systems Engineering
This introductory course addresses the application of scientific and engineering efforts in order to translate specific operational requirements into a system configuration. The course emphasizes a goal-and-team-oriented approach to representative system projects. The goal of this total engineering effort is the creation of an effective and efficient product within specified cost, time and performance envelopes.
Prerequisite(s): MATH1030 (or higher).
Offered at Providence
3 Semester Credits

ENGN3090 Systems Performance and Measurement
This course addresses the critical role of performance in the modeling, design, assessment, operation and management of a system. Emphasis is placed on the identification and development of both qualitative performance criteria and quantitative performance criteria. Data-acquisition and processing requirements for these criteria are also considered both for online and offline system assessment.
Prerequisite(s): ENGN3085.
Offered at Providence
3 Semester Credits

ENGN3130 Design II: Iteration and Design Development
This course is a continuation of the design process from a fundamental principles of design course. Concepts of schematic design, iteration and documentation is coordinated with a design for manufacturability and assembly focus. Students learn how to develop designs that satisfy programmatic needs through examination of the whole concept down to the detail, tested through drawing, computer modeling, physical models and prototypes. Students learn how to apply design requirements in order to identify best solutions. Design is documented with a thorough exploration of form, function and mechanism.
Prerequisite(s): CAD2030.
Offered at Providence
3 Semester Credits

ENGN3150 Solid State Devices
This course focuses on the characteristics and application of semiconductor devices in circuit design. The terminology, symbols, and applications of switching and rectifier diodes, Zener diodes, bipolar (BJT) transistors and Field effect (FET) transistors are examined. Circuit applications of power supplies, voltage regulation, small-signal amplifiers and power amplifiers are included.
Prerequisite(s): ENGN2101, ENGN2102, MATH1040, Corequisite: ENGN3151.
Offered at Providence
3 Semester Credits

ENGN3151 Solid State Devices Lab
This course includes laboratory project activities requiring design, simulation, implementation, measurement and testing of circuits to meet design specifications. Labs are designed to reinforce concepts discussed in Solid State Devices, ENGN3150.
Prerequisite(s): ENGN2101, ENGN2102, MATH1040, Corequisite: ENGN3150.
Offered at Providence
1 Semester Credit

ENGN3180 Microelectronics Design
This is a project-oriented design course. Topics covered include contemporary design methodologies, prototyping platforms, programmable devices, hardware description language, as well as design, verification, realizations of digital systems and their building blocks. This course also covers the process of development and prototyping of electronic systems starting from problem statement to final fabrication at system and board level.
Prerequisite(s): ENGN2085, ENGN2014 or ENGN2205.
Offered at Providence
3 Semester Credits

ENGN3302 Robotics
This course introduces students to the fundamental concepts and applications of robotics including the supporting disciplines of mechanics, motors, microprocessors, and the use of various sensors in robotic systems. Real-time programming and theoretical analysis of electrical, pneumatic and hydraulic servo control systems are covered as well as the theory and application of various sensors such as proximity, light, infrared, ultrasonic and vision. Students utilize microprocessor and microcontroller interfacing and engineering problem-solving skills in the creation of robotic projects in the course. Other topics of discussion and analysis include industrial applications in areas of automotive, semiconductor manufacturing, medical and aerospace.
Prerequisite(s): CSIS2023 or CSIS2050 or ENGN2009.
Offered at Providence
3 Semester Credits

ENGN3303 Industrial Robotics
This course includes an introduction to industrial robots, work cell integration, and manufacturing concepts with an emphasis on the implementation of Lean Manufacturing through design, integration and operation. Students explore how assembly line robots integrate into industrial production and how communications among Computer Numerical Control (CNC) machines, sensors, and pneumatic devices combine to make work cells. Simulated exercises and demonstrations reinforce the theory presented in lecture with practical applications.
Prerequisite(s): ENGN2101, ENGN2102, ENGN3302.
Offered at Providence
3 Semester Credits

ENGN3350 Mechatronics
This course is a study of the basic mechanical components and electrical drives in mechatronics systems. Topics covered include basic functions and physical properties of mechanical components and electrical drivers, as well as strategies to identify, localize and correct malfunctions.
Prerequisite(s): ENGN2035, ENGN2205.
Offered at Providence
3 Semester Credits

ENGN4000 Standards/Codes and Ergonomics
This course is an introduction to standards and regulatory codes governing products and manufacturing procedures. Standards for procedures and processes as related to design and manufacturing are defined and case studies are used to develop relevant concepts. Codes and ergonomic concepts are presented and developed as the driving forces behind standards applied to products and manufacturing procedures.
Offered at Providence
3 Semester Credits

ENGN4005 Quality Control/Professional Practice
This course is an introduction to quality control and professional practice as related to design and configuration management, with the concept of QC as the techniques and activities to achieve, sustain and improve the quality of products, services and the project development. Quality control becomes the responsibility of everyone involved in the design of products or project management. Professional practices covers the general application of regulations, restrictions, record keeping, and ethics related to engineering design and project management.
Offered at Providence
3 Semester Credits

ENGN4010 Configuration Management
This course is an introduction to Configuration Management (CM) as a solution to engineering problems. Students are introduced to project management, change orders, documentation revision, product and project flow processes. Applications of CM are applied to the private corporate sector as well as to government agencies.
Prerequisite(s): Junior or senior status.
Offered at Providence
3 Semester Credits

ENGN4030 Digital Signal Processing
This course involves the study of Fourier analysis for discrete-time and continuous-time signals and systems, difference equation, Z-transforms, digital filter structures and transfer functions. Analysis of sampling and aliasing effects are also presented with design algorithms for IIR and FIR Digital filters. Digital signal processing functions are also discussed. In addition, the course covers selected, basic concepts in electronic communications such as the electromagnetic spectrum, modulation and demodulation, and transmission and reception of signals.
Prerequisite(s): MATH2043.
Offered at Providence
3 Semester Credits

ENGN4075 Robotics & Automation I
This course introduces students to the concepts and applications of robotics and automation. The study of robotics includes the supporting disciplines of mechanics, motors, microcontrollers, various sensors and artificial intelligence. The course covers the concepts of work envelope, real-time programming, and the theory of electrical, pneumatic and hydraulic servo control systems. Also, the theory and application of various sensors including temperature, proximity, ultrasonic and vision sensors, the use of microcontrollers, microcontroller interfacing, and artificial intelligence in robotic systems are addressed. Concepts in automation are covered, including manufacturing systems and elements in work cell.
Prerequisite(s): ENGN3015 or ENGN3350.
Offered at Providence
3 Semester Credits

ENGN4080 Robotics & Automation II
This is a design course incorporating the material studied in the areas of mechatronics, artificial intelligence and computer vision. The course integrates areas of knowledge in microcontroller interface for data acquisition of discrete, digital and analog data, robot kinematics, sensor design and sensor interfacing, communication, basic concepts in navigation and real-time programming.
Prerequisite(s): ENGN4075.
Offered at Providence
3 Semester Credits

ENGN4130 Design III: Project Resolution and Detailing
This course is the final design course in a three-course sequence. Concepts of the design process are applied to industrial design problems and project development techniques. Configuration management techniques are developed to support design analysis and product/project development through the life cycle of the product/project. Students develop research and presentation skills related to the design process, cost estimating and project development centered on industrial and urban problem-solving techniques.
Prerequisite(s): ENGN3130.
Offered at Providence
3 Semester Credits

ENGN4140 Capstone Design I
This is the first design course in a two-course capstone design sequence. This is a project-oriented course in which engineering students participate as a member of an engineering design team to apply engineering principles acquired through their academic and project experiences to complete a project plan for a design project. The design project includes real-world constraints, engineering standards, and the implementation of various hardware and software engineering and/or other science disciplines. Team members employ various interpersonal and research skills in executing the project plan which includes considerations for social, environmental, global impact, and other relevant factors. Student teams demonstrate proof of concept and prepare and deliver a written and oral presentation on the design proposal. Student teams work closely with faculty to regularly assess the progress of the project through interim reporting.
Prerequisite(s): ENGN3180, senior status.
Offered at Providence
3 Semester Credits

ENGN4145 Capstone Design II
This is the second design course in a two-course capstone design sequence. This course is a continuation of ENGN4XXX. This is a project-oriented course in which engineering students participate as a member of an engineering design team to apply engineering principles acquired through their academic and project experiences in the implementation and materialization of the design project and the building of a prototype. Student teams focus on various engineering tasks while executing project activities, including design of digital intellectual property for embedded systems, hardware and software design testing, implementation, validation, reviewing, refining, and demonstration of the results of project activities. Student teams document their final design solution in a written report and make a final oral presentation where they demonstrate a functional prototype. Student teams work closely with faculty to regularly assess the progress of the design project through interim reporting.
Prerequisite(s): ENGN4140.
Offered at Providence
3 Semester Credits