

# GENERAL ENGINEERING (ENGR)

## ENGR 102 Introduction to Engineering 1 Credit Hour(s)

This course will introduce students to the engineering profession and the study skills necessary to succeed in the rigorous course of study to achieve an engineering degree. Students will be taught how to think critically and reason analytically in order to skillfully navigate the course of instruction they have chosen to pursue and to be equipped for success in that profession. This is a required course for all engineering majors.

**Offered:** Resident

## ENGR 105 Introduction to Engineering I 2 Credit Hour(s)

**Online Prerequisite:** MATH 128 (may be taken concurrently) or MATH 130 (may be taken concurrently) or MATH 131 (may be taken concurrently) or MATH 132 (may be taken concurrently)

This course will introduce students to the engineering profession, the entrepreneurial mindset, and the study skills necessary to succeed in the rigorous course of study to achieve an engineering degree. The course introduces fundamental engineering concepts, including spreadsheets, dimensions and units, engineering communication, engineering ethics and the engineering design process. This is a required course for online engineering majors and also serves non-engineering students by exposing them to an overview of the engineering discipline.

**Offered:** Online

## ENGR 110 Introduction to Engineering Fundamentals 3 Credit Hour(s)

**Prerequisite:** MATH 128 (may be taken concurrently) or MATH 131 (may be taken concurrently) or MATH 132 (may be taken concurrently)

Introduction to engineering problem solving techniques, the engineering design process, and the engineering profession. This course also introduces students to the various engineering disciplines offered at Liberty University and enables them to chart a path to success in achieving their engineering degree, as well as helping students understand what they must do to excel in their studies. This course also serves non-engineering students by exposing them to an overview of the engineering discipline. This course is mandatory for all engineering majors.

**Offered:** Resident

## ENGR 115 Introduction to Engineering II 2 Credit Hour(s)

**Online Prerequisite:** ENGR 105 and (MATH 128 (may be taken concurrently) or MATH 130 (may be taken concurrently) or MATH 131 (may be taken concurrently) or MATH 201 (may be taken concurrently) or MATH 217 (may be taken concurrently))

This course is a study of the fundamental engineering concepts of length, time, mass, force, temperature, electricity, energy and power, with a focus on developing strong problem-solving skills and becoming analytical, detail-oriented and creative engineers. Understanding of the fundamental engineering concepts is reinforced through practical analytical exercises and completion of a team design project. This course serves as the foundation for entry into engineering disciplinary studies and is a required course for online engineering majors.

**Offered:** Online

## ENGR 125 Visualization for Engineers 1 Credit Hour(s)

**Prerequisite:** ENGR 110

To train students on graphical applications of vital and practical importance in engineering. The intention is to assist students to improve their three-dimensional spatial cognitive skills. The creation and interpretation of graphical communication will be introduced. Concepts include: two and three-dimensional part and assembly representations, dimensioning and tolerance as a link between design and manufacturing, introduction to solid modeling and virtual prototyping.

**Offered:** Resident

## ENGR 133 Calculus with MATLAB 1 Credit Hour(s)

**Prerequisite:** MATH 131 (may be taken concurrently)

This course is intended to be an introductory MATLAB Lab in which the topics of arithmetic, algebra, plotting, preparation of m-files, limits, derivatives, related rates, optimization, integration, and other engineering-related topics will be investigated.

**Note:** This course is intended for Engineering, Computer Science or Internet Technology majors only.

**Offered:** Resident and Online

## ENGR 200 Engineering Design Competition 1 Credit Hour(s)

ENGR 200 helps students in a competition team develop a project management skill and learn system engineering design approach reflecting Creationeering™ to prepare for an engineering design competition. Students will contribute to design and fabrication tasks, writing interim (progressive reports) and final reports.

**Offered:** Resident

## ENGR 202 Introduction to Creationeering 3 Credit Hour(s)

This course aims to educate the student in the Creationeering paradigm. The three primary elements of Creationeering are: 1. Creator-inspired design, 2. Creator-revealed engineering, 3. Creator-led entrepreneurship. If you want to learn more about our Creator & discover how He inspires us to design and create new products and businesses, this class is for you.

**Offered:** Resident

## ENGR 210 Probability and Statistical Methods for Engineering 3 Credit Hour(s)

**Resident Prerequisite:** ((CSCI 110 or CSIS 110 or ENGR 110 or ENGR 115) and MATH 131 )

**Online Prerequisite:** ((ENGR 110 or ENGR 115 or CSCI 110 or CSIS 110) and MATH 131 )

Introduction to applied probability and the principles and methodologies of statistical inference. Topics include methods of data analysis, point and interval estimation; test of hypotheses, correlation, regression and an introduction to analysis of variance methods.

**Offered:** Resident and Online

## ENGR 235 Statics 3 Credit Hour(s)

**Prerequisite:** PHYS 231

A study of 2D and 3D force systems, equilibrium, structures, distributed forces, shear and bending moment diagrams, friction, and area moments of inertia. Analysis of the static equilibrium of rigid bodies and fluids in static conditions. Topics include free-body diagram, concentrated forces, distributed forces, forces due to friction, and inertia forces, as well as their application to the analysis of machines, structures and systems.

**Offered:** Resident and Online

**ENGR 240 Dynamics 3 Credit Hour(s)****Prerequisite:** ENGR 235

A study of force action related to displacement, velocity and acceleration of particles and rigid bodies using translation and rotation, work and energy and impulse and momentum principles. Course is presented in two parts: the geometric aspects of the motion, or kinematics; and the analysis of forces causing the motion, or kinetics.

**Offered:** Resident and Online**ENGR 245 High Performance Computing 3 Credit Hour(s)**

Linux Programming High performance computing exposes students to high performance computing (HPC) environments, which include an overview of typical HPC software/hardware, the Linux operating system, and an introduction to scripting/programming and management software. Students will study typical HPC environments and explore uses of these complex systems in business and research. Students will also have opportunities to interact with, design, and develop activities on an HPC system. • Building the box - Assembling the hardware & network • OS installation • Mini Introduction to the Linux OS (CentOS) • Introduction to Fortran, C, Python • Parallel computing • Programming and simulations

**Offered:** Resident**ENGR 270 Technical Communication 3 Credit Hour(s)****Prerequisite:** ENGL 101

This course will teach students how to write documents representing the three main types of technical writing: operational (instructional), promotional (argumentative and analytical), and reportorial (expository, informational and analytical). Students will also evaluate and edit documents belonging to these categories by examining how well these documents serve their purpose for particular audiences in different cultural and social contexts. Students will study and practice communicating ideas competently in diverse public and private speaking venues.

**Offered:** Resident and Online**ENGR 277 Engineering Ethical and Legal Issues 3 Credit Hour(s)****Prerequisite:** (BWVW 102 or GNED 102) or (BWVW102 Exempt with a score of 5)

Introduction to the ethical and legal issues encountered during the development of engineering projects from a Christian perspective. Topics include copyrights, patents, contracts, environmental responsibility, personnel management, and professionalism. (Formerly ENGR 377)

**Offered:** Resident**ENGR 299 Internship 0 Credit Hour(s)**

Professional internship providing opportunity for controlled learning experience specific to engineering disciplines. Enrollment specific to international students (F-1 Status) requiring Curricular Practical Training (CPT) endorsement (I-20 work authorization). Application components processed concurrently through School of Engineering and International Student Center. Candidates must apply semester prior to internship.

**Registration Restrictions:** Sophomore status, minimum 2.00 GPA, declared major, two courses within major discipline, full-time enrollment, valid passport and F1 Status greater than 1 year.

**Offered:** Resident**ENGR 313 Mechatronics 4 Credit Hour(s)****Prerequisite:** MATH 334 and PHYS 231 and PHYS 232

An introductory study of the fundamental principles and technologies found in modern computer-controlled machines and processes, or mechatronics systems. Students learn about the four main components of a mechatronic system: sensors, actuators, motion transmission mechanisms, and controllers. Students are expected to design and build a mechatronic system. (Formerly ENGR 213)

**Registration Restrictions:** Junior Status**Offered:** Resident**ENGR 315 Fluid Dynamics 3 Credit Hour(s)****Resident Prerequisite:** MATH 231 and ENGR 235**Online Prerequisite:** MATH 430 and ENGR 235

To provide an understanding of both the kinematics and kinetics of fluids. Students gain knowledge on the fundamental conservation laws of mass, momentum, and energy. Students will be expected to gain an ability to solve and design engineering problems involving pipe flow, turbomachines, pumps, large reservoirs, etc. Topics include: the Reynolds transport theorem, The Bernoulli's equation, applications of fluid momentum to propellers, wind turbines, turbojets, and rockets, differential fluid flow analysis, dimensional analysis and similitude, Reynolds number and flow classification, analysis and design for pipe flow, flow over external surfaces and boundary layer, cavitation and turbo machines.

**Offered:** Resident and Online**ENGR 320 Thermodynamics 3 Credit Hour(s)****Prerequisite:** MATH 231 and PHYS 231

A study of the laws of thermodynamics, equations of state, kinetic theory, chemical equilibrium and phase changes.

**Offered:** Resident**ENGR 330 Mechanics of Materials 3 Credit Hour(s)****Prerequisite:** ENGR 235

A thorough study of the principles that govern the internal effects of stress and strain in solid bodies that are subjected to external loading. The purpose is to enable the engineering student to design solid components and structures by selecting materials and geometry. Students learn to compare strength of materials against internal stresses, and deformation of materials against internal strains. Topics also include: mechanical properties of materials, types of loading, plane-stress and plane-strain conditions, design of beams and shafts, and buckling.

**Offered:** Resident and Online**ENGR 360 Heat Transfer 3 Credit Hour(s)****Prerequisite:** (PHYS 320 or ENGR 320) and MATH 334

A study of the fundamentals of the three traditional forms of heat transfer: conduction, convection, and radiation. Both steady state as well as transient heat transfer are introduced. The concept of numerical methods in the solution of realistic heat conduction problems is presented. Students are exposed to external and internal forced as well as natural convective heat transfer. Selection and design of heat exchangers are introduced both theoretically and practically.

**Offered:** Resident**ENGR 370 Quality Assurance 3 Credit Hour(s)****Prerequisite:** ENGR 210

Introduction to the principles involved in designing statistical quality control systems. Topics include probability concepts, density and distribution functions, control chart concepts and sampling inspection plans.

**Offered:** Resident and Online

**ENGR 381 Introduction to Optimum Design 3 Credit Hour(s)**

**Resident Prerequisite:** ENGR 210 and MATH 131 and MATH 132 and MATH 231 and PHYS 231 and PHYS 232

**Online Prerequisite:** ENGR 210 and MATH 131 and MATH 132 and MATH 430 and PHYS 231 and PHYS 232

Introduction to the design process. Topics include system engineering, team dynamics, design specifications, conceptual design, scheduling, developing a business plan, market survey, and budgeting.

**Registration Restrictions:** Chair approval, Junior/Senior Status

**Offered:** Resident and Online

**ENGR 385 Thermodynamics II 3 Credit Hour(s)**

**Prerequisite:** ENGR 320 or PHYS 320

To bridge the gap between knowledge of fundamentals of thermodynamics and its applications. Students are presented a wealth of real-world engineering examples involving thermal systems. Starting with the ideal concept of exergy, students are introduced to gas power cycles, vapor and combined power cycles, refrigeration cycles, for pure substances and mixtures. Other topics include chemical reactions, chemical and phase equilibrium, and compressible flow.

**Offered:** Resident

**ENGR 405 Dynamic Systems Modeling 3 Credit Hour(s)**

**Prerequisite:** MATH 334 and ENGR 240

A study of the modeling, simulation, and control of mechatronic systems. Upon successful completion of this course, students will be able to: develop mathematical models of real systems; use techniques to analyze and understand systems behavior; use modern computational tools to simulate the dynamic response of systems to external stimuli; and design automatic control systems. Topics will include: dynamic models, linearity and nonlinearity of systems, multiport systems and bond graphs, basic bond graph elements, various types of mechanical and electrical systems, state-space equations and automated simulations, and analysis and control of linear systems. (Formerly ENGR 365)

**Offered:** Resident

**ENGR 444 God, Science, and Creation 3 Credit Hour(s)**

**Prerequisite:** ((MATH 126 or MATH 131) and (PHYS 201 or PHYS 231))

This course aims to help the student unite the areas of God, Engineering, Math, and Science to integrate the Christian worldview in all engineering design and management decisions. Hence, we focus on various science areas (physics, biology, geology, etc.), engineering, and math to realize our goal.

**Offered:** Resident

**ENGR 470 Technology and Business Development Practicum I 3 Credit Hour(s)**

**Prerequisite:** BUSI 336 and BUSI 338 and ENGR 102 and ENGI 220

The practicum experience provides students the opportunity to apply and integrate knowledge acquired through coursework. In clarifying and broadening career goals, the practicum experience assists students in discovering, developing, and refining necessary competencies and skills for their proposed career objectives. Practicum experience is intended to provide students with the opportunity of applying their entrepreneurial skills in actual business, technical, or professional situations in the context of Liberty University's Creationeering™ paradigm.

**Offered:** Resident

**ENGR 475 Technology and Business Development Practicum II 3 Credit Hour(s)**

**Prerequisite:** ENGR 470

The practicum experience provides students the opportunity to apply and integrate knowledge acquired through coursework. In clarifying and broadening career goals, the practicum experience assists students in discovering, developing, and refining necessary competencies and skills for their proposed career objectives. Practicum experience is intended to provide students with the opportunity of applying their entrepreneurial skills in actual business, technical, or professional situations in the context of Liberty University's Creationeering™ paradigm.

**Offered:** Resident

**ENGR 481 Engineering Design I 3 Credit Hour(s)**

**Resident Prerequisite:** Computer Engineering Gate Req with a score of 5 or Electrical Engineering Gate Req with a score of 5 or Indust Sys Engineer Gate Req with a score of 5 or Mechanical Engineer Gate Req with a score of 5 or Civil Engineering Gate Req with a score of 5

**Online Prerequisite:** (MATH 334 or MATH 432) and Civil Engineering Gate Req with a score of 5 and PHYS 232

This is the first senior design course where students are exposed to engineering design and product/process development. Students work in teams on engineering design projects from inception to completion to satisfy the needs and requirements of the clients. In addition to technical design, factors such as safety, economics, and ethical and societal implications are considered.

**Note:** ENGR 481 and ENGR 482 represent two parts of the same project; therefore, they must be taken in consecutive terms.

**Offered:** Resident and Online

**ENGR 482 Engineering Design II 3 Credit Hour(s)**

**Resident Prerequisite:** ENGR 481

**Online Prerequisite:** ENGR 481 and Civil Engineering Gate Req with a score of 5

The third course in the design sequence where the student is exposed to engineering design and development. Design process culminates in prototype development, gathering performance data and presenting a final design briefing to peers and department faculty.

**Offered:** Resident and Online

**ENGR 495 Directed Research 3 Credit Hour(s)**

Research-oriented project or an independently completed course of study in a specially designed area as approved and supervised by the instructor. May be repeated for up to 6 credits or as approved by the department chair.

**Registration Restrictions:** Written permission of the chairman of the department in area of concentration and consent of instructor.

**Offered:** Resident

**ENGR 497 Special Topics in Engineering 1-3 Credit Hour(s)**

**Offered:** Resident

**ENGR 499 Internship 3 Credit Hour(s)**

Professional internship providing opportunity for controlled learning experience specific to engineering disciplines and student's chosen specialization. Applications are reviewed by Faculty Intern Advisor and processed through the School. Candidates must apply semester prior to internship.

**Registration Restrictions:** Junior or senior standing within major discipline, minimum 2.5 GPA, declared major, completion of at least 15 hours in major courses.

**Offered:** Resident