

BACHELOR OF SCIENCE DEGREE

GENERAL EDUCATION CURRICULUM

and Additional Degree Requirements

Engineering Science

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The Engineering Science degree is a wonderful way for liberal arts students to receive a multidisciplinary engineering program that emphasizes enhanced understanding and integrated application of engineering, science, computer programming and math concepts. This program provides students with a broad foundation in these disciplines within the Christian context and liberal arts atmosphere of Howard Payne University.

In addition to taking core courses in mathematics, physics, chemistry, and computer information technology, students study statics, dynamics, mechanics of materials, thermodynamics, fluids, circuit analysis and environmental issues and engineering. During the senior year, all students select a focus area of study, complete a capstone project and write a thesis that integrates the scientific principles of research, design and analysis and applies them to engineering.

Is this Major Right for You?

- Do you want to make a difference for humanity?
- Do you work hard on your studies and are careful about getting things right?
- Do you enjoy figuring out how things work and figure ways to make them work better?
- Do you want to share your Christian "fruits of the spirit" in a ministry of service?
- Do you have the academic fortitude to complete this intensive program?

Engineering Science will require a lot of study. It is not an easy degree to pursue and a lot of time and energy needs to be spent obtaining the degree. Your course load and study time will be heavier than many of your non-engineering friends at Howard Payne. You must be able to focus on your studies for hours on end. Calculus and Physics are just preparatory courses for your engineering courses. Focus on your goals, budget your time, learn to think critically and creatively and you will succeed.

The Engineering Science Program

The Engineering Science Program provides students with multidisciplinary training in physical science, mathematics, economics, computer programming, technical writing, and basic engineering. Students with this degree will be qualified to enter the work force directly as engineering assistants or pursue bachelor's or master's degrees in engineering disciplines of their choice from accredited institutions. High school physics and four years of high school mathematics are recommended for preparation. Students weak in mathematics or science may require more than four years to complete the degree. Click here to see a possible 4 year plan starting with Calculus I; Starting with College Algebra.

Program educational objectives and outcomes:

- 1 The student can apply knowledge of mathematics, science and engineering.
- 2 The student can design experiments as well as analyze and interpret data.
- 3 The student can design a system to meet desired needs within realistic constraints.
- 4 The student can function on multidisciplinary teams.
- 5 The student can identify, formulate and solve engineering problems.

- 6 The student can understand professional and ethical responsibility.
- 7 The student can communicate effectively.
- 8 The student can understand the impact of engineering solutions in a global, economic, environmental and societal context.
- 9 The student recognizes the need for, and ability to engage in life-long learning.
- 10 The student has a knowledge of contemporary issues.
- 11 The student has a desire to serve God and humanity.

GENERAL EDUCATION

GEN 1101 University Seminar	1 hours
BIB 1303 Introduction to the Old Testament	3 hours
BIB 1304 Introduction to the New Testament	3 hours
ESS 1100 Principles of Personal Fitness & Wellness	1 hours
Exercise & Sport Science Activity chosen from approved courses	2 hours
GEN 4100 Senior Seminar	1 hours
COM 1310 Fundamentals of Human Communication	3 hours
ENG 1311 English Composition I	3 hours
ENG 1312 English Composition II	3 hours
MAT 1351 College Algebra or above	3 hours
CHE 1479 General Chemistry I.....	4 hours
English Literature - ENG 2351 or 2353 or 2373	3 hours
HIS 1320 U.S. History Since 1877	3 hours
POS 2311 American government	3 hours
PSY 1311 Introduction to Psychology or SOC 1311 Intro. to Sociology.....	3 hours
Fine Arts (GEN 1311, ART 1361, MUS 1353 or THR 1311).....	3 hours
Total General Education	42 hours

General Education Requirements 42 hours

Additional Degree Requirements 15 hours

MAT 2342 Intro. to Prob. & Stat., or MAT 4341 Prob. and Stat.

CHE 1489 General Chemistry II

MAT 2451 Calculus I

MAT 2461 Calculus II

Additional Science Requirements 8 hours

PHY 2439 University Physics I

PHY 2449 University Physics II

Additional Mathematics Requirements 10 hours

MAT 3361 Calculus III

MAT 3302 Linear Algebra

MAT 3451 Differential Equations

Computer Information Systems Requirements 12 hours

CIS 1339 Introduction to Information Technology or CIS elective

CIS 1359 Programming Logic

CIS 3309 Object Oriented Programming II

CIS 3319 Project Management

Additional Miscellaneous Requirements 6 hours

ECO 2301 Principles of Macroeconomics

Core Engineering Science Course Requirements28 hours

ENS 1101 Introduction to Engineering I	1 hour
ENS 1102 Introduction to Engineering II	1 hour
ENS 1204 (CIS 1204) Engineering Graphics I	2 hours
ENS 1379 Engineering Principles and Practice	3 hours
ENS 2403 Statics and Dynamics.....	4 hours
ENS 2332 Mechanics of Materials.....	3 hours
ENS 3331 Thermodynamics	3 hours
ENS 3359 Mechanics of Fluids.....	3 hours
ENS 4303 Environmental Issues.....	3 hours
ENS 4409 Fundamentals of Circuit Analysis.....	4 hours
ENS 4100 Engineering research proposal.....	1 hour

Additional electives 3 hours

Preferred but not required electives are:

MAT 4312 Advanced Differential Equations	3 hours
MAT 4471 Numerical Analysis	4 hours
ENS 4309 Research Problems in Engineering	3 hours

Total Credit Hours 124 hours

The Engineering Science degree includes 14 hours of advanced engineering, 10 – 17 hours of advanced mathematics, and 6 hours of advanced computer information systems.

All prerequisites must carry a grade of “C” or better, and Engineering Science majors must carry a grade of “C” or better in all ENS courses.

ENGINEERING SCIENCE 1101. INTRODUCTION TO ENGINEERING I.

An introduction to the engineering profession, including ethics, design and teamwork, communication, estimation, and problem solving. One hour lecture per week. Fall.

Prerequisite: Credit or concurrent enrollment in CIS 1339.

One semester hour

ENGINEERING SCIENCE 1102. INTRODUCTION TO ENGINEERING II.

A continuation of ENS 1101. Topics include units and dimensions, graphs, mathematical models, logic, and basic statistics. One hour lecture per week. Spring.

Prerequisite: ENS 1101.

One semester hour

ENGINEERING SCIENCE 1204. ENGINEERING GRAPHICS.

An introduction to computer-aided drafting and sketching using computer aided design (CAD) software or Maple-Sim to generate drawings incorporating the conventions of engineering graphics. Two hours per week. Fall.

Prerequisite: ENS 1102.

Two semester hours

ENGINEERING SCIENCE 1379. ENGINEERING PRINCIPLES AND PRACTICES.

A course designed to begin development of engineering problem-solving skills in complement with computer tools. Three hours lecture per week. Spring.

Prerequisite: ENS 1102 and MAT 1351 or higher.

Two semester hours

ENGINEERING SCIENCE 2403. STATICS AND DYNAMICS.

Statics: Force- and moment-vectors; equivalent force-couple systems; force equilibrium and free body diagrams; trusses, beams, and cables; dry frictional forces; centroids, distributed loads, and hydrostatics; moments of inertia; virtual work. Dynamics: Position, velocity, and acceleration; Newton's laws of motion; linear and curvilinear motion; particle and rigid body kinematics; linear and angular momentum; work-energy; elastic impact and impulse-momentum; vibrations and periods of oscillation. Four hours lecture per week. Fall.

Prerequisites: Physics 2439 and credit or concurrent enrollment in MAT 2461.

Four semester hours

ENGINEERING SCIENCE 2332. MECHANICS OF MATERIALS.

Stress and strain in materials; axial deformation and Hooke's law; normal and shear stress/strain and the linear constitutive law; multi-axial loading; transformation of stress/strain and Mohr's circle; torsion of circular shafts; shear- and moment-diagrams for beams; beam stresses and deflections; statically indeterminate and composite beams; pressure vessels; columns; combined loading; and Castigliano's theorem. Three hours lecture per week. Spring.

Prerequisites: ENS 2403 and credit or concurrent enrollment in MAT 3361.

Three semester hours

ENGINEERING SCIENCE 3331. THERMODYNAMICS.

Introduction to the fundamental principles of classical engineering thermodynamics. Application of mass and energy balances to closed and open systems including systems undergoing transient processes. Entropy generation and the second law of thermodynamics for closed and open systems. Introduction to phase equilibrium and chemical reaction equilibria. Ideal solution behavior. Three hours lecture per week. Spring.

Prerequisites: PHY 2449, CHE 1489, and MAT 2461.

Three semester hours

ENGINEERING SCIENCE 3359. MECHANICS OF FLUIDS.

Fundamentals of fluid flow. Conservation laws for mass, momentum and mechanical energy. Flow of fluids in conduits and past immersed bodies. Newton's laws of viscosity, momentum transport, laminar and turbulent flow. Velocity profiles, piping systems, pumping and mixing. Three hours lecture per week. Spring.

Prerequisites: ENS 2403 and MAT 3361.

Three semester hours

ENGINEERING SCIENCE 4409. FUNDAMENTALS OF CIRCUIT ANALYSIS.

Fundamentals of analog and digital circuits using Laplace transforms and graphics technology, including transient and steady state responses. Three hours lecture and three hours laboratory per week. Fall.

Prerequisites: PHY 2449 and MAT 3451.

Four semester hours

ENGINEERING SCIENCE 4303. ENVIRONMENTAL ISSUES.

A study of environmental principles and issues addressing topics of laws and regulations, economics, point and nonpoint source pollution, toxic materials, natural resources, air and water quality, biodiversity, ecosystems, and environmental technology, including "green" technologies. Local field trips to study real world applications will be required. Three hours lecture per week. Spring.

Prerequisites: ECO 2301 and MAT 2345 or higher.

Three semester hours

ENGINEERING SCIENCE 4100. Engineering Research Proposal.

A course emphasizing hypothesis formulation, the writing of a research proposal, and searching the scientific and engineering literature. Spring.

Prerequisites: Senior standing in the Engineering Science Program.

One semester hour

ENGINEERING SCIENCE 4309. Research Problems in Engineering.

Implementation of an engineering research proposal via design of an experiment(s), collecting and analyzing data, drawing logical conclusions from the data, and formulating an approach to solve the problem. Such might entail student internships with an outside company. Spring.

Prerequisites: Credit or concurrent enrollment in ENS 4100.

Three semester hours