

# Mechanical Engineering, B.S.

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## About

- Bachelor of Science in Mechanical Engineering
- Bachelor of Science in Mechanical Engineering, Honors

Mechanical Engineers apply the principles of solid mechanics, thermal fluid sciences, dynamics and control, material science and manufacturing science to the analysis and design of systems of all types. In applying this technical knowledge to fields such as energy systems, nanomanufacturing and robotics, the mechanical engineer must consider economic constraints and the social and ecological implications of solutions imposed. The mechanical engineering curriculum offers the student an opportunity to pursue educational objectives within the framework of this broad theme.

## Mission Statement

We are committed to providing a rigorous educational experience in the discipline of mechanical engineering, graduating well-rounded leaders and life-long learners, who aspire to achieving professional excellence. We are *equally* committed to the discovery, dissemination, advancement and application of cutting-edge research. Inspired by the Augustinian tradition, we value an inclusive and diverse community in which we prepare our students to demonstrate the highest ethical conduct and contribute to the well-being of humankind.

## Program Educational Objectives

Our graduates will:

- Be valued members of their organizations because of their skills and abilities as mechanical engineers;
- Solve complex technical problems and/or design systems that are useful to society by applying the fundamental scientific principles that underpin the mechanical engineering profession;
- Advance in their chosen career paths by utilizing technical, leadership, communication, and interpersonal skills, with the highest ethical standards;
- Apply their knowledge and skills to successfully practice professions of their choice;
- Demonstrate professional and personal growth by pursuing or successfully completing an advanced degree, professional development courses, and/or engineering certification;
- Be actively engaged in service to their professions and communities, consistent with the tradition of St. Augustine.

The first year of the mechanical engineering program is devoted to laying a foundation of mathematics, physical science, and the general engineering sciences. The final three years are devoted primarily to mechanical engineering topics. The required courses span the field of mechanical engineering, and electives provide the opportunity to pursue specific areas of mechanical engineering in greater depth through technical concentrations which include Mechanics and Materials, Thermal/Fluid Systems, and Dynamic Systems. A student opting for a technical concentration will first take an elective in the junior year which corresponds to their selected technical concentration. Each student will then customize the

program of study by choosing four courses (12 credit hours) of technical electives in the senior year. To complete the technical concentration, two of these mechanical engineering technical electives must be selected from the designated set of concentration classes. In addition, the student must take the senior laboratory course from their technical concentration. A student who completes a technical concentration will have the concentration indicated on the final transcript. Students who do not opt for a concentration will still take a junior year restricted elective and a senior lab; the four senior year mechanical engineering electives can be chosen freely from all offerings.

The engineering design process is emphasized throughout the program and culminates with a senior year project that requires a synthesis of basic principles learned in previous courses.

Throughout the curriculum the technical courses are balanced by a careful selection of humanities courses to ensure that the effects of technology on society are given due consideration in design.

A faculty advisor is assigned to each student at the beginning of their first-year to provide academic and career guidance for the remainder of the student's years in the program until graduation. The advisor should be consulted regarding such topics as electives, minors or concentrations, graduate studies, undergraduate research, and completion of degree requirements for graduation.

**Program:** [Engineering](#)

**Type:** Bachelor of Science

## Freshman Year

### First Semester

Course	Title	Credits
ACS 1000	Ancients	3
THL 1000	Faith, Reason, and Culture	3
CHM 1103	General Chemistry Lab I	1
CHM 1151	General Chemistry I	4
MAT 1500	Calculus I	4
EGR 1200	Egr. Interdisciplinary Proj. I	3
EGR 1001	Career Compass First Yr A	0.5

### Second Semester

Course	Title	Credits
ACS 1001	Moderns	3
MAT 1505	Calculus II	4
PHY 2400	Physics I Mechanics	3
ME 1201	Intro to Comp Aid Design&Draft	1
ME 1205	Computer Program for Mech Engr	3
	Elective	3
EGR 1002	Career Compass First Yr B	0.5

# Sophomore Year

## First Semester

Course	Title	Credits
MAT 2500	Calculus III	4
ME 2100	Statics	3
ME 2505	M.E. Analysis & Design	4
PHY 2402	Physics II Elec & Magnet	3
PHY 2403	Phy Lab for Engineering	1
EGR 2003	Career Compass Second Yr A	0.5

## Second Semester

Course	Title	Credits
MAT 2705	Diff Equation with Linear Alg	4
ME 2900	ME Laboratory I	1
ME 3100	Thermodynamics	3
ME 2103	Mechanics of Materials	3
ME 2101	Dynamic Systems I	3
COM 1102	COM Foundations for Engrs	3
EGR 2004	Career Compass Second Yr B	0.5

# Junior Year

## First Semester

Course	Title	Credits
ECE 2030	Electric Circuits Fundamentals	3
ECE 2031	Elect Circuit Fundamentals Lab	1
ME 3102	Dynamic Systems II	3
ME 3402	Solid Mechanics & Design I	3
ME 3600	Fluid Mechanics	3
ME 3950	Heat Transfer I	3
EGR 3005	Career Compass Third Yr A	0.5

## Second Semester

Course	Title	Credits
ME 3300	Materials Science I	3
ME 3333	Manufacturing Engineering	3
ME 3900	ME Laboratory II	1
	Elective - Restricted ME	3
	Elective	3
	Elective	3
EGR 3006	Career Compass Third Yr B	0.5

# Senior Year

## First Semester

Course	Title	Credits
ME 5005	Capstone Design I	2
	Elective - ME/Concentration	3
	Elective - Career/ME	3
	Elective - Restricted ME Lab	1
	Elective	3
	Elective	3

## Second Semester

Course	Title	Credits
ME 5006	Capstone Design II	2
	Elective - ME/Concentration	3
	Elective - Career/ME	3
	Elective	3
	Elective	3

## Category Descriptions

### Elective

Credits: 3

Electives are subject to change. Electives may be added to this list at the discretion of the College of Engineering.

Select one course from each of the elective groups below.

## One Theology or Philosophy Elective

Select one theology or philosophy course (3 or more credits) from the list below:

- Theology (THL) course or course with CTHL (Core Theology) attribute, at the 2000 level or above
- Philosophy (PHI)
- Peace and Justice (PJ)
- [ETH 2050](#) - The Good Life: Ethics & Cont Prob
- [EGR 2930](#) - Catholic Social Teaching for EGRs
- Any Humanities or Social Science course with a PJ (Peace and Justice) attribute

## One Upper Level Theology Elective

Select one upper level theology course (3 or more credits) from the list below:

- Theology (THL) course at the 2000 level or above
- Course with CTHL (Core Theology) attribute at the 2000 level or above

## One Humanities and Social Science Elective

Select one humanities or social science course (3 or more credits) from the list below:

### Humanities:

- Arab & Islamic Studies
- Art History
- Classical Studies
- Communications
- Ethics
- English - ENG 1050, 1975, 2100-9999
- Global Interdisciplinary Studies
- History
- Honors Program (eligible students only)
- Humanities
- Modern Languages (except speaking courses in native language)
- Philosophy
- Theatre
- Theology (2000 and above or course section with CTHL Core Theology attribute)

### Social Sciences:

- Criminology
- Economics
- Geography and the Environment - GEV 1002, 1500-3900, 4050-5300
- Humanities: HUM designated PSC
- Peace and Justice
- Political Science
- Public Administration
- Psychology
- Sociology
- Gender and Women's Studies

## One Science Elective

Select one science course (3 or more credits) from the list below:

- BIO >1200
- CHM >1151
- AST >2000
- PHY >2415

## One Ethics Elective

Any (3-credit) ETH > 2000 course from ethics department, or any course with Ethics (ETH) attribute, or an ethics course from the students minor (including [NS 4200](#) & [VSB 2007](#)), or a course from other departments with a focus on ethical issues such as [EGR 2001](#) and those with the word ethics in the title.

## One Statistics Elective

Course	Title	Credits
STAT 4310	Stat Methods	3
STAT 5700	Math Statistics I	3

## One Free Elective

Any three- or more credit course or any combination of one- and two-credit courses (adding up to three credits or more) from Villanova University.

### Elective - Restricted ME

Credits: 3

Electives are subject to change. Electives may be added to this list at the discretion of the College of Engineering.

If a concentration is chosen, students must take the appropriate courses in their concentration, including the below:

- Restricted ME Elective
- Restricted ME Lab
- Six credits from the approved list of courses for the concentration

Course	Title	Credits
ME 3103	Dynamic Systems III	3
ME 3403	Solid Mechanics & Design II	3
ME 4850	Thermal-Fluid System Design	3

## Elective - ME/Concentration

Credits: 3

Electives are subject to change. Electives may be added to this list at the discretion of the College of Engineering.

- If obtaining a concentration, both courses must come from that concentration. [View all concentration electives below.](#)
- Any ME 5000 through 8999 course for others.

Note: Graduate courses are subject to additional requirements. [ME 5000](#) and [ME 5001](#) require approval from the department chair and the advisor.

## Solid Mechanics Concentration Electives

Course	Title	Credits
ME 5000	Selected Topics in ME	3
ME 5001	ME Undergraduate Research I	3
ME 5201	Intro to Finite Elements	3
ME 5206	Aircraft Design	3
ME 5500	Biomechanics	3
ME 7000	Advanced Engineering Analysis	3
ME 7002	Continuum Mechanics	3
ME 7030	Num Methods for Eng Simulation	3
ME 7040	Intro to Fin Element Analysis	3
ME 7070	Aero Vehicle Struc Analy & Des	3
ME 7250	Nano/Microscale Mater Behavior	3
ME 7260	Mechanic Behavior of Materials	3
ME 7270	Polymer Engineering	3
ME 7280	Additive Manufacturing	3
ME 7501	Reinforced Comp Materials	3
ME 7502	Fiber Composite Structures	3
ME 7550	Biomechanics of Hard Tissues	3
ME 7560	Biomechanics of Soft Tissues	3
ME 8040	Adv Fin Element Analysis	3
ME 8200	Elasticity & Stress Analysis	3
ME 8350	Applied Fracture Mechanics	3

## Dynamic Systems Concentration Electives

<b>Course</b>	<b>Title</b>	<b>Credits</b>
ME 5000	Selected Topics in ME	3
ME 5001	ME Undergraduate Research I	3
ME 5201	Intro to Finite Elements	3
ME 5205	Flight Dynamics	3
ME 5206	Aircraft Design	3
ME 5207	Orbital Mechanics	3
ME 5411	Mechatronics	3
ME 5421	Introduction to Robotics	3
ME 5441	Advanced System Modeling	3
ME 7000	Advanced Engineering Analysis	3
ME 7030	Num Methods for Eng Simulation	3
ME 7040	Intro to Fin Element Analysis	3
ME 7060	Multiphysics Sys Modelng & Sim	3
ME 7205	Advanced Dynamics	3
ME 7206	Dynamics of Rotating Machinery	3
ME 7207	Simulation of Multibody System	3
ME 8000	Adv. Engineering Analysis II	3
ME 8204	Robotics:Analysis & Control	3
ME 8207	Vibration Analysis	3
EGR 8308	Feedforward Control	3
EGR 8310	Optimization for Engineers	3
EGR 8311	Machine Learning for Engineers	3
EGR 8301	Control Systems Engineering	3
EGR 8304	Nonlinear Control	3
EGR 8305	System Identification	3
EGR 8306	Nonlinear Dynamics	3

## Thermal /Fluids Concentration Electives

Course	Title	Credits
ME 5000	Selected Topics in ME	3
ME 5001	ME Undergraduate Research I	3
ME 5101	Elements of Aerodynamics	3
ME 5102	Compressible Fluid Flow	3
ME 5130	Intro to Sustainable Energy	3
ME 5140	Design of Gravity Water Ntwrks	3
ME 5201	Intro to Finite Elements	3
ME 5206	Aircraft Design	3
ME 5441	Advanced System Modeling	3
ME 7000	Advanced Engineering Analysis	3
ME 7002	Continuum Mechanics	3
ME 7030	Num Methods for Eng Simulation	3
ME 7038	Intro-Computational Fluid Mech	3
ME 7040	Intro to Fin Element Analysis	3
ME 7103	Advanced Engrg Thermodynamics	3
ME 7140	Thermal Energy Storage	3
ME 7150	Sustainable Energy	3
ME 7240	Constructal Theory and Design	3
ME 7600	Thermal Mgmnt of Electronics	3
ME 7700	Tran Phen in Bio Systems	3
ME 8038	Adv Computational FluidDynamic	3
ME 8100	Fund of Cond & Rad Heat Trans	3
ME 8103	Advanced Fluid Mechanics	3
ME 8120	Convection Heat Transfer	3
ME 8150	Multiphase Flow & Heat Trans.	3
ME 8250	Microscale Heat Transfer	3
EGR 7800	Solar Therm. Energy Conversion	3

### Elective - Career/ME

Credits: 3

One course from:

- ME 5000 through 8999
- Approved elective from other Engineering Department: CHE 5000-8999, CEE 4000-8999, ECE 5000-8999, EGR 7000-8999, SUSE 7000-8999
- Approved elective from hard sciences: AST 4000-8999, BIO 4000-8999, CHM 4000-8999, CSC 4000-8999, ENV 4000-8999, GEV 4000-8999, MAT 4000-8999, PHY 4000-8999
- Courses from student's completed minor or second major.

Note: Graduate courses are subject to additional requirements.

### Elective - Restricted ME Lab

Credits: 1

If a concentration is chosen, students must take the appropriate courses in their concentration, including the below:

- Restricted ME Elective
- Restricted ME Lab
- 6 credits from the approved list of courses for the concentration

Course	Title	Credits
ME 4001	Dynamic Systems Lab	1
ME 4002	Solid Mechanics Lab	1
ME 4003	Thermal Fluids Lab	1