



ENGINEERING – BIOMEDICAL TRACK (2021-2022)
ENGINEERING – COMPUTER TRACK (2021-2022)
ENGINEERING – ELECTROMECHANICAL TRACK (2021-2022)
MECHANICAL ENGINEERING (2021-2022)
Division of Mathematics, Engineering & Computer Science
Robert Keller, Ph.D., Chair

The engineering program engages students in a rigorous, challenging, and comprehensive study of the fundamentals in engineering, mathematics, and science required to analyze, design, build, test and operate engineered systems in a manner that emphasizes interdisciplinary leadership that contributes to the profession and to society. It is expected that graduates use their problem solving and analytical skills to benefit society in a manner consistent with Catholic Social Teaching.

The engineering program offers a mechanical engineering degree and an engineering degree. The mechanical engineering degree focuses on the fundamentals of the transformation of energy from one form to another to do useful work, leading to a B.S. in Mechanical Engineering. The engineering degree offers a choice of three tracks to earn a B.S. in Engineering. These tracks are Biomedical, Computer, and Electromechanical. Each of these tracks focuses on both theory and design related to the track. Graduates of the Biomedical track are prepared to design and test electrical and mechanical systems that interface with biological systems. The Computer track emphasizes the development of computer controlled electrical and mechanical systems. The Electromechanical track deals with the design, development and test of mechanical systems with electronic controls.

Student Learning Outcomes – Engineering	
1.	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2.	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3.	An ability to communicate effectively with a range of audiences.
4.	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5.	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6.	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7.	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Requirements for the major in Engineering (B.S.) – Biomedical track:

A grade of C- or better is required in all courses taken for the major.

Req	Course	Cr's
1	L.CHE-111/L.CHE-111L: General Chemistry I w/Lab	4
2	L.CHE-233/L.CHE-233L: Organic Chemistry I w/Lab	4
3	L.BIO-115/L.BIO-115L : Principles of Biology I-ES w/Lab	4
Select one from Req 4:		
4	L.BIO-225: Anatomy & Physiology	4
4	L.BIO-420: Vert Physiology	4
5	L.MAT-150: Calculus of One Variable I-FM	4
6	L.MAT-160: Calculus of One Variable II	4
7	L.MAT-260: Analytic Geometry and Calculus III	4
8	L.MAT-310: Ordinary Differential Equations	3
9	L.PHY-223: Physics for Engineers I-QR	5
10	L.PHY-224: Physics for Engineers II	5
11	L.PHY-290: Physics Lab I-QR	0
12	L.PHY-291: Physics Lab II	0
13	L.EGR-105: Introduction to Engineering Design-EC	3
14	L.EGR-116: Intro to Programming with Robotics-ES	4
15	L.EGR-231: Engineering Statics	3
16	L.EGR-232: Engineering Dynamics	3
17	L.EGR-236: Properties and Mechanics of Materials	4
18	L.EGR-308: Biomechanics & Biomaterials	3
19	L.EGR-333: Fluid Mechanics	3
20	L.EGR-334: Thermodynamics	3
21	L.EGR-335: Electric Circuits	3
22	L.EGR-342: Modeling and Control of Dynamic Systems	3
23	L.EGR-350: Engineering Laboratory I	1
24	L.EGR-351: Engineering Laboratory II	1
25	L.EGR-352: Engineering Laboratory III	1
26	L.EGR-353: Engineering Laboratory IV	1
Select one from Req 27: Engineering Elective		
27	L.EGR-200: Engineering Prototyping	3
27	L.EGR-250: NASA Astronautics	3
27	L.CSC-225: Data Structures & Algorithms	4
27	L.CSC-319 Computer Organization & Architecture	4
28	L.EGR-490: Engineering Capstone Design I-PJ, IN	3
29	L.EGR-491: Engineering Capstone Design II	3
30	L.EGR-492: Engineering Capstone Design III	3
89-90 total required credits		

Requirements for the major in Engineering (B.S.) – Computer track:
 A grade of C- or better is required in all courses taken for the major.

Req	Course	Cr's
1	L.CHE-111/L.CHE-111L: General Chemistry I w/Lab	4
2	L.CSC-225: Data Structures & Algorithms	4
3	L.CSC-319: Computer Organization & Architecture	4
4	L.MAT-150: Calculus of One Variable I-FM	4
5	L.MAT-160: Calculus of One Variable II	4
6	L.MAT-230: Discrete Mathematics	4
7	L.MAT-310: Ordinary Differential Equations	3
8	L.PHY-223: Physics for Engineers I-QR	5
9	L.PHY-224: Physics for Engineers II	5
10	L.PHY-290: Physics Lab I-QR	0
11	L.PHY-291: Physics Lab II	0
12	L.EGR-105: Introduction to Engineering Design-EC	3
13	L.EGR-116: Intro to Programming with Robotics-ES	4
14	L.EGR-231: Engineering Statics	3
15	L.EGR-232: Engineering Dynamics	3
16	L.EGR-335: Electric Circuits	3
17	L.EGR-342: Modeling and Control of Dynamic Systems	3
18	L.EGR-350: Engineering Laboratory I	1
19	L.EGR-352: Engineering Laboratory III	1
20	L.CSC-325: Algorithm Design & Analysis	3
21	L.CSC-440: Operating Systems	3
Select one from Req 22: Computer Science Elective		
22	L.CSC-332: Web Programming	3
22	L.CSC-310: Artificial Intelligence	3
22	L.CSC-311: Human Computer Interaction	3
22	L.CSC-340: Machine Learning	3
22	L.CSC-350: Computer Graphics	3
Select one from Req 23: Engineering Elective		
23	L.EGR-200: Engineering Prototyping	3
23	L.EGR-250: NASA Astronautics	3
23	L.EGR-236: Properties and Mechanics of Materials	4
23	L.EGR-308: Biomechanics & Biomaterials	3
23	L.EGR-333: Fluid Mechanics	3
23	L.EGR-334: Thermodynamics	3
24	L.EGR-490: Engineering Capstone Design I-PJ, IN	3
25	L.EGR-491: Engineering Capstone Design II	3
26	L.EGR-492: Engineering Capstone Design III	3
27	Math/Science Elective: Any L.BIO, L.CHE, L.NEU, any L.MAT-200 level or above, L.PHY-208 or L.PHY-331.	3-4
82-84 total required credits		

Requirements for the major in Engineering (B.S.) – Electromechanical track:

A grade of C- or better is required in all courses taken for the major.

Req	Course	Cr's
1	L.CHE-111/L.CHE-111L: General Chemistry I w/Lab	4
2	L.CSC-225: Data Structures & Algorithms	4
3	L.CSC-319: Computer Organization & Architecture	4
4	L.MAT-150: Calculus of One Variable I-FM	4
5	L.MAT-160: Calculus of One Variable II	4
6	L.MAT-260: Analytic Geometry and Calculus III	4
7	L.MAT-310: Ordinary Differential Equations	3
8	L.PHY-223: Physics for Engineers I-QR	5
9	L.PHY-224: Physics for Engineers II	5
10	L.PHY-290: Physics Lab I-QR	0
11	L.PHY-291: Physics Lab II	0
12	L.EGR-105: Introduction to Engineering Design-EC	3
13	L.EGR-116: Intro to Programming with Robotics-ES	4
14	L.EGR-231: Engineering Statics	3
15	L.EGR-232: Engineering Dynamics	3
16	L.EGR-236: Properties and Mechanics of Materials	4
17	L.EGR-333: Fluid Mechanics	3
18	L.EGR-334: Thermodynamics	3
19	L.EGR-335: Electric Circuits	3
20	L.EGR-342: Modeling and Control of Dynamic Systems	3
21	L.EGR-350: Engineering Laboratory I	1
22	L.EGR-351: Engineering Laboratory II	1
23	L.EGR-352: Engineering Laboratory III	1
24	L.EGR-353: Engineering Laboratory IV	1
Select one from Req 25: Engineering Elective		
25	L.EGR-200: Engineering Prototyping	3
25	L.EGR-250: NASA Astronautics	3
25	L.EGR-308: Biomechanics & Biomaterials	3
25	L.CSC-325: Algorithm Design & Analysis	3
25	L.CSC-332: Web Programming	3
25	L.CSC-440: Operating Systems	3
25	L.CSC-310: Artificial Intelligence	3
25	L.CSC-311: Human Computer Interaction	3
25	L.CSC-340: Machine Learning	3
25	L.CSC-350: Computer Graphics	3
26	L.EGR-490: Engineering Capstone Design I-PJ, IN	3
27	L.EGR-491: Engineering Capstone Design II	3
28	L.EGR-492: Engineering Capstone Design III	3
29	Math/Science Elective: Any L.BIO, L.CHE, L.NEU, any L.MAT-200 level or above, L.PHY-208 or L.PHY-331.	3-4
85-86 total required credits		

Requirements for the major in Mechanical Engineering (B.S.):

A grade of C- or better is required in all courses taken for the major.

Req	Course	Cr's
1	L.CHE-111/L.CHE-111L: General Chemistry I w/Lab	4
2	L.EGR-105: Introduction to Engineering Design-EC	3
3	L.EGR-116: Intro to Programming with Robotics-ES	4
4	L.EGR-231: Engineering Statics	3
5	L.EGR-232: Engineering Dynamics	3
6	L.EGR-236: Properties and Mechanics of Materials	4
7	L.MAT-150: Calculus of One Variable I-FM	4
8	L.MAT-160: Calculus of One Variable II	4
9	L.MAT-260: Analytic Geometry and Calculus III	4
10	L.MAT-310: Ordinary Differential Equations	3
11	L.PHY-223: Physics for Engineers I-QR	5
12	L.PHY-224: Physics for Engineers II	5
13	L.PHY-290: Physics Lab I-QR	0
14	L.PHY-291: Physics Lab II	0
15	Math/Science Elective: Any L.BIO, L.CHE, L.NEU, any L.MAT-200 level or above, L.PHY-208 or L.PHY-331.	3-4
16	L.EGR-242: Manufacturing Process & Design	3
17	L.EGR-333: Fluid Mechanics	3
18	L.EGR-334: Thermodynamics	3
19	L.EGR-335: Electric Circuits	3
20	L.EGR-336: Materials Science	3
21	L.EGR-337: Heat Transfer	3
22	L.EGR-338: Machine Design	3
23	L.EGR-339: Instrumentation	4
24	L.EGR-342: Modeling and Control of Dynamic Systems	3
25	L.EGR-350: Engineering Laboratory I	1
26	L.EGR-351: Engineering Laboratory II	1
27	L.EGR-352: Engineering Laboratory III	1
28	L.EGR-353: Engineering Laboratory IV	1
29	L.EGR-490: Engineering Capstone Design I-PJ, IN	3
30	L.EGR-491: Engineering Capstone Design II	3
31	L.EGR-492: Engineering Capstone Design III	3
90-91 total required credits		

Requirements for the minor in Engineering:

A grade of C- or better is required in all courses taken for the minor.

Req	Course	Cr's
1	L.EGR-105: Introduction to Engineering Design-EC	3
2	L.EGR-231: Engineering Statics	3
3	L.PHY-223: Physics for Engineers I-QR	5
4	L.MAT-150: Calculus of One Variable I-FM	4
5	L.MAT-160: Calculus of One Variable II	4
Select two from Req 6		
6	L.EGR-116: Intro to Programming with Robotics-ES	4
6	L.EGR-232: Engineering Dynamics	3
6	L.EGR-236: Properties and Mechanics of Materials	4
6	L.EGR-200: Engineering Prototyping	3
6	L.EGR-250: NASA Astronautics	3
6	L.EGR-308: Biomechanics & Biomaterials	3
6	L.EGR-333: Fluid Mechanics	3
6	L.EGR-334: Thermodynamics	3
6	L.EGR-335: Electronic Circuits	3
6	L.EGR-342: Modeling & Control of Dynamics Systems	3
25 to 27 total required credits		

2021-2022 ENGINEERING COURSES:

L.EGR-105: Introduction to Engineering Design-EC

This course will focus specifically on the areas of problem solving and design. Students will learn to use modern tools to address engineering problems. As part of the design process, students will learn to draw both using manual sketches as well as SolidWorks CAD software. Students will then apply these skills to create a unique design. 3 credits.

L.EGR-116: Intro to Programming with Robotics-ES

Students learn and practice scientific methodology as well as the basics of programming, variables, control statements, and functions as applied to programming real-time robotics. Learning to write computer programs requires some background in mathematics beyond basic algebra with knowledge of the properties of mathematical functions. A student with this knowledge may take the course without the math prerequisite. Prerequisite: L.MAT-117 or higher or consent of instructor. 4 credits. Offered every spring term.

L.EGR-200: Engineering Prototyping

This course serves as an introduction to engineering design prototypes. The primary focus will be on the design, prototype, and test processes associated with creating a prototype. These prototypes will target designing electromechanical or biomedical systems. Skills practiced include teaming, project and time management, locating materials and services, conflict resolution, experimental design, oral and written reports. Students will complete self-reflection and self-assessment exercises. 3 credits.

L.EGR-231: Engineering Statics

An introduction to engineering statics. Topics include vectors, resultants, equilibrium, structural analysis, centroids, shear and bending moment diagrams, friction, and moment of inertia. Prerequisite: L.MAT-150 or above. 3 credits.

L.EGR-232: Engineering Dynamics

An introduction to engineering dynamics. Topics include kinematics and kinetics (displacement, velocity, acceleration, work, energy, impulse, and momentum) for particles and rigid bodies. Prerequisites: Sophomore standing; L.EGR-231. 3 credits.

L.EGR-236: Properties & Mechanics of Materials

Introduction to materials and solid mechanics of typical engineering materials. Introduces basic theory of deformable bodies by analyzing stress/strain relationships in objects. Topics in solid mechanics include strains, stresses, Mohr's Circle, deflections of beams, and simple structural members. Prerequisites: L.MAT-160 or higher, L.EGR-231. 4 credits.

L.EGR-242: Manufacturing Processes & Design

Method of commercial manufacturing. Includes topics of casting, forging, forming, joining, cutting, drilling, milling, and lathe work. Also includes designing parts to make them easy to manufacture, workshop laboratories where students learn basic use and safety of metal and wood working equipment; completion of a project where students design and construct a project of their choosing; and tours of local manufacturing facilities. There are no prerequisites although a CAD background may be helpful. 3 credits.

L.EGR-250: NASA Astronautics

Hands-on, engineering-based activities and with data collection technology integration for real-world analysis. Project-based learning that includes sustainable habitat construction, strategic scientific planning and investigations, a two-stage rocket launch, heat shield design, cryogenics chamber design, robotics underwater "astronaut training," collaborative teaming and global awareness development. Behind-the-scenes access to including tours of actual astronaut training and work facilities, such as NASA Johnson Space Center, Rocket Park and the Neutral Buoyancy Laboratory. Hear from guest speakers about what it takes to work at NASA and the projects that prepare humans for space exploration. Prerequisite: MAT 117 or higher. 3 credits.

L.EGR-294: Engineering Internship

Engineering elective credit for structured work experiences in engineering practice within industry or government. Hours worked determine the number of credits. Prerequisite: At least two EGR courses. Proposals must be arranged with and approved by Program Chair.

L.EGR-308: Biomechanics and Biomaterials

This course provides an introduction to the interaction of artificial components with both the in vivo mechanics and biochemistry. Specific topics include the structure, function, and mechanical properties of biological tissues and biomaterials as well as biological responses and toxicity. This information is used then to identify the optimal materials to use for a variety of biomedical applications (drug delivery, stents, replacement joints, etc.) This course is required for the Biomedical Engineering option but will also be open to other students on campus interested in the subject. This includes in particular pre-health students who want to have a better understanding of biomechanics and biomaterials. Prerequisites: L.CHE-111, L.PHY-223. 3 credits.

L.EGR-333: Fluid Mechanics

The laws of fluid statics and dynamics. Topics include properties of substances, fluid statics, the energy equation, the momentum equation, and viscous effects in external and internal flows. Prerequisites: L.EGR-232; L.MAT-260; L.PHY-223. 3 credits.

L.EGR-334: Thermodynamics

The laws of thermodynamics. Topics include: properties of substances and phase equilibrium, the first and second laws of thermodynamics, entropy, power cycles and refrigeration cycles. Prerequisites: L.MAT-260; L.PHY-223. 3 credits.

L.EGR-335: Electric Circuits

Introduction to DC and AC circuit analysis using Laplace Transforms, Kirchhoff's laws, network simplification, nodal and loop techniques. Consideration of amplifiers, power supplies and discrete circuit elements including resistors, capacitors, inductors, diodes, transistors, and operational amplifiers. Introduction to circuit analysis tools. Prerequisites: L.PHY-224; L.MAT-310. 4 credits.

L.EGR-336: Material Science

Course description forthcoming. 3 credits.

L.EGR-337: Heat Transfer

Course description forthcoming. 3 credits.

L.EGR-338: Machine Design

Course description forthcoming. 3 credits.

L.EGR-339: Instrumentation

Course description forthcoming. 4 credits.

L.EGR-342: Modeling & Control of Dynamic Systems

Modeling and analysis of dynamic systems and controls in the electrical and mechanical realms. Categories of models include linear vs. nonlinear, 1st vs. 2nd order, continuous vs. discrete, transient, steady-state, and frequency responses. Open-loop and closed-loop control systems. Modeling will include computer simulations. Prerequisites: L.EGR-232; L.MAT-310; L.EGR-116 or equivalent; L.PHY-224. 3 credits.

L.EGR-350: Engineering Laboratory I

This is a laboratory course associated with the L.EGR-335: Electric Circuits course. A lab course in which students design, build and test electric circuits of various types. Circuits that interface with mechanical systems are emphasized. Prerequisites: L.MAT-310; L.EGR-116 or equivalent; L.PHY-224. Co-requisite: L.EGR-335. 1 credit.

L.EGR-351: Engineering Laboratory II

This is a laboratory course associated with the L.EGR-333: Fluid Dynamics course. This course will be focused on examining phenomena in fluid flow such as fluid statics, fluid energy, momentum, internal flows, drag, and viscous effects. This course will integrate engineering topics such as thermodynamics, controls, dynamic systems, circuits, dynamics and statics. Prerequisites: L.EGR-232; L.MAT-260 L.EGR-116 or equivalent; L.PHY-223. Co-requisite: L.EGR-333. 1 credit.

L.EGR-352: Engineering Laboratory III

This is a laboratory course associated with the L.EGR-342: Dynamic Systems course. This course will be focused on examining phenomena in modeling and control of systems in the mechanical and electrical realms. This course will integrate engineering topics such as thermodynamics, fluid dynamics, circuits, dynamics and statics. Prerequisites: L.EGR-232; L.MAT-310; L.EGR-116 or equivalent; L.PHY-224. Co-requisite: L.EGR-342. 1 credit.

L.EGR-353: Engineering Laboratory IV

This is a laboratory course associated with the L.EGR-334: Thermodynamics course. This course will be focused on modeling of thermodynamic systems (such as heat transfer and power cycles) and design of thermodynamics systems. This course will integrate engineering topics such as fluid dynamics, dynamic systems, circuits, dynamics and statics. Prerequisites: L.MAT-260, L.EGR-116 or equivalent; L.PHY-223. Co-requisite: L.EGR-334. 1 credit.

L.EGR-394: Engineering Internship

Engineering elective credit for structured work experiences in engineering practice within industry or government. Hours worked determine the number of credits. Prerequisite: At least two EGR courses numbered 200 or above. Proposals must be arranged with and approved by Program Chair.

L.EGR-490: Engineering Capstone Design I-PJ, IN

First part of year-long, multidisciplinary team-based, open-ended engineering design project. Projects will target designing electromechanical systems. Skills practiced include teaming, project and time management, conflict resolution, literature search, job search, experimental design, oral and written reports. Prerequisites: L.EGR-105, L.EGR-116, L.EGR-231, L.EGR-232, two 300+ level L.EGR courses, and L.MAT-310. Completion of three of the five AGE categories is highly recommended. 3 credits.

L.EGR-491: Engineering Capstone Design II

Second part of year-long, team-based, open-ended engineering design project. Projects will target designing electromechanical systems. Skills practiced include teaming, project and time management, locating materials and services, conflict resolution, experimental design, oral and written reports. Design process will consist of students taking part in a simulated industrial workplace setting. Students will interact with local companies to evaluate and access available resources and services. Students will complete self-reflection and self-assessment exercises. Prerequisite: L.EGR-490. 3 credits. January term.

L.EGR-492: Engineering Capstone Design III

Third part of year-long, team-based, open-ended engineering design project. Projects will target designing electromechanical systems. Skills practiced include analysis and assessment, testing, redesign, project and time management, oral and written reports. Culmination of the project will include a poster presentation, formal written report, and team oral presentation. Course will also include preparation and review of topics for taking of the FE Examination. Prerequisite: L.EGR-491. 3 credits.

L.EGR-494: Engineering Internship

Engineering elective credit for structured work experiences in engineering practice within industry or government. Hours worked determine the number of credits. Prerequisite: At least two EGR courses numbered 300 or above. Proposals must be arranged with and approved by Program Chair.