

**New Undergraduate Program (Majors, Minors, Sequences) Proposal
Illinois State University - University Curriculum Committee**

Program Department Engineering
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Title of New Program Engineering

Submission Date Tuesday, March 7, 2023
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Version 3 **ID** 426
Proposed Starting Catalog Year 2024-2025

Associated Course Proposal(s):

New Course proposal EGR 201 titled *Engineering Prepstone*
 New Course proposal EGR 310 titled *Robotics & Automation*
 New Course proposal EGR 395 titled *Engineering Capstone I*
 New Course proposal EGR 396 titled *Engineering Capstone II*
 New Course proposal ELE 200 titled *Electrical Engineering Design*
 New Course proposal ELE 207 titled *Electrical & Electronic Prototyping*
 New Course proposal ELE 215 titled *Semiconductor Devices: Ultra- & Large-scale Integration*
 New Course proposal ELE 320 titled *Structure & Design of Digital Systems*
 New Course proposal ELE 321 titled *Computer Engineering*
 New Course proposal ELE 322 titled *Electromagnetics: Fundamentals and Applications*
 New Course proposal ELE 331 titled *Wireless Communication and Power Transmission*
 New Course proposal ELE 332 titled *Electrical Power Transmission & Smart Grids*
 New Course proposal ELE 333 titled *Semiconductor Device Design & Fabrication*

1. Proposed Action

- ✓ New Major **Major CIP Code** 14.010
 New Minor
 New Sequence
 More than 50% of courses in this program are Distance Education

Degree Type(s)

Bachelor of Science

2. Provide Undergraduate Catalog copy for new program.**Degree Requirements**

Minimum required credit hours: 98

Major Requirements

- EGR 100
- EGR 101
- EGR 102
- EGR 150
- EGR 155
- EGR 160
- EGR 170
- EGR 200
- EGR 201
- EGR 395
- EGR 396
- MAT 145
- MAT 146
- MAT 148
- MAT 149
- MAT 252
- MAT 260
- IT 166
- PHY 110
- PHY 111
- PHY 112
- CHE 140

Take one of the following

- ELE 207
- MEC 207

Take seven senior-level (minimum 21 credit hours) engineering (EGR, ELE, or MEC) elective courses; up to two courses may be substituted from outside of engineering, by advisor approval.

Notes

EGR 395 and 396 (Engineering Capstone I and II) must be taken during the Senior year (i.e., requires 90 completed credit hours).

3. Provide a description for the proposed program.

The Bachelor of Science in Engineering (BSE) degree provides students an opportunity to develop and expand their technical background by pursuing a program of study that matches their own interests and professional goals within the framework of an ABET-accredited degree. The first three semesters of the BSE, BSEE, and BSME programs are identical. The fourth semester of the BSE includes a BSE Prestone course wherein students identify and plan an area of concentration for the final four semesters of their program. Through independent research and study with a faculty mentor, students investigate their proposed technical concentration area in the BSE Prestone. Areas of concentration are interdisciplinary and may include Sustainability, Agricultural, and Assistive Technologies Engineering or Engineering Entrepreneurship. In addition to the Capstone courses required in the BSE, BSEE, and BSME, the BSE also includes a third-year internship or research immersion experience that embeds students in the practice of their chosen concentration.

4. Provide a rationale of proposed program.

While the mechanical and electrical engineering undergraduate degrees within the college of engineering emphasize the quantitative and analytical side of those fields, they lack a breadth of coverage and do not afford the chance to explore an emerging STEM field. General engineering degrees offer career opportunities different from those of the specialized engineering degrees as general engineering students, within the College of Engineering, to develop a program that satisfies their own intellectual and professional objectives through interdepartmental and interdisciplinary program opportunities. General engineering degrees allows students to go into engineering jobs in control engineering, sensors and data processing, telecommunications, computing, energy, transport and utilities companies, architectural and design companies, mobile technologies, biomedical engineering, engineering consultancies or academia. General graduates are in demand in the job market.

Any reading(s) of MAT 147a01 should be read as MAT 148. The course in question had a change in number later in the curriculum process. Everything else with the course has stayed the same.

5. Describe the expected effects of the proposed program on existing campus programs (if applicable).

The first cohort of approximately 130 students across all three EGR degree programs will begin in the fall of 2025, 16% (~20) of which will be Engineering majors. A steady state goal is about 520 students across all three programs, with about 80 of them being Engineering majors. These students will complete the following courses in other ISU academic units as part of their major requirements, requiring additional sections of the following courses to accommodate this degree program. The estimated additional enrollment is 130 students across all three new engineering programs; estimating additional enrollment across all new programs allows for a more holistic perspective on the additional number of sections required. The semester most likely to experience increased enrollment is provided in parentheses, assuming most students follow the recommended plan of study.

PHY 110 (fall semester)

PHY 111 (spring semester)

PHY 112 (spring semester)

CHE 140 (fall semester)

MAT 145 (fall semester)

MAT 146 (spring semester)

MAT 148 (fall semester)

IT 166 (fall semester)

6. Provide a sample four-year plan of study that fulfills the following requirements: 120 hours, 42 senior college hours (200 and 300 level courses), and 39 General Education Program hours or 36 hours with exemption. If the program is a BS program, show the BS-SMT degree requirement. If the program is from CAS, show Foreign Language Requirement (LAN 111/LAN 112). Confirm General Education requirement exemptions on the General Education page of the current Academic Catalog. *4-year plans are not required for minor program proposals.*

Sample Plan of Study

The requirements below pertain to this Undergraduate Catalog year and are intended as a guide for academic planning. Students should consult with their academic advisor to discuss their individual plan of study.

Min. of 122 total credit hours required, including 42 senior level hours (200-300 level)

First Year - Fall Semester (15 credit hours)

ENG 101 or COM 110 (General Education) (3)

MAT 145 (General Education) (4)

EGR 100 (1)

EGR 102 (3)

PHY 110 (4)

First Year - Spring Semester (15 credit hours)

ENG 101 or COM 110 (General Education) (3)

MAT 146 (BS SMT elective) (4)

EGR 101 (1)

EGR 150 (3)

PHY 111 (4)

Second Year - Fall Semester (15 credit hours)

EGR 155 (3)

MAT 148 (B.S.-SMT) (4)

CHE 140 (General Education) (4)

IT 166 (4)

Second Year - Spring Semester (16 credit hours)

EGR 160 (3)

EGR 170 (4)

MAT 149 (3)

EGR 201 (3)

AMALI General Education course (3)

Third Year - Fall Semester (16 credit hours)

Natural Science elective (4)

ELE 207 or MEC 207 (3)

EGR 200 (3)

IDEAS General Education course (3)

General Education course (3)

Third Year - Spring Semester (15-18 credit hours)

MAT 252 or 260 (3-4)

General Education course (3)

300-level Engineering Elective (MEC, ELE, or EGR) (3-4)

300-level Engineering Elective (MEC, ELE, or EGR) (3-4)

Engineering Undergraduate Research or Internship (3)

Fourth Year - Fall Semester (14-15 credit hours)

MAT 252 or MAT 260 (3-4)

General Education course (3)

EGR 395 (4)

300-level Engineering Elective (MEC, ELE, or EGR) (3-4)

Fourth Year - Spring Semester (15 credit hours)

General Education course (3)

EGR 396 (4)

300-level Engineering Elective (MEC, ELE, or EGR) (4)

300-level Engineering Elective (MEC, ELE, or EGR) (4)

7. **Describe the expected curricular changes required, including new courses. If proposals for new courses have also been submitted, please reference those related proposals here:**

New general engineering courses being developed for this degree program:

EGR 100: Engineering Problems Using Mathematics I (1)
 EGR 102: Engineering Explorations (3)
 EGR 102A01: Engineering Explorations for Transfer Students (3)
 EGR 101: Engineering Problems Using Mathematics II (1)
 EGR 150: Introduction to Engineering Design (4)
 EGR 155: Engineering Thermodynamics (3)
 EGR 160: Ideation & Prototyping in Design (3)
 EGR 170: Analog & Digital Circuits (4)
 EGR 200: Projects in Electrical-Mechanical Integration (3)
 EGR 201: Engineering Prestone (3)
 EGR 310: Robotics & Automation (4)

New electrical engineering courses developed, from which this degree program may draw:

ELE 200: Electrical Engineering Design (3)
 ELE 203: Signals & Systems (3)
 ELE 207: Electrical and Electronic Prototyping (3)
 ELE 215: Semiconductor Devices: Ultra- & Large-Scale Integration (3)
 ELE 320: Structure & Design of Digital Systems (3)
 ELE 321: Computer Engineering for Engineers (3)
 ELE 322: Electromagnetics: Fundamentals & Applications (4)
 ELE 331: Wireless Communication & Power Transmission (4)
 ELE 332: Electrical Power Transmission & Smart Grids (4)
 ELE 333: Semiconductor Device Design & Fabrication (4)

New mechanical engineering courses developed, from which this degree program may draw:

MEC 195: Engineering Mechanics with Applications
 MEC 205: Mechanical & Electro-mechanical Analysis & Design
 MEC 207: Mechanical Prototyping
 MEC 215: Thermal Fluids Engineering
 MEC 220: Strength of Materials
 MEC 316: Computer-aided Engineering of Mechanical & Thermal Systems
 MEC 321: Control Systems
 MEC 322: Vibration Analysis & Control
 MEC 331: Computer-integrated Manufacturing
 MEC 332: Energy Engineering & Power Generation Systems
 MEC 333: Biomechanics & Biomaterials

New mathematics courses being developed for this degree program:

MAT 148: Calculus III for Engineers (4)
 MAT 149: Engineering Mathematics (3)

The ad-hoc Engineering Curriculum Committee has developed the above courses, through consultation with a Provost Emeritus from Olin College of Engineering and iterative review by practicing engineers, engineering faculty and administrators from other engineering programs, and ISU faculty who hold engineering degrees and/or engineering education expertise. This plan outlines the likely third and fourth years of the curriculum, which will serve as guidance to faculty as they are hired to refine the remaining curriculum when hired.

Potential general engineering courses to be developed after faculty hires:

EGR XXX Prototyping & Fabrication Practices for Engineers (3)
 EGR XXX Undergraduate Research or Internship (3)
 EGR/BUS XXX Engineering & Entrepreneurship (3)
 EGR XXX Renewable Energy Systems (3)

EGR XXX Fundamentals of Engineering for Sustainability (3)

EGR XXX Global Sustainability Engineering (4)

EGR XXX Water and Soil Systems Management (3)

EGR XXX Agricultural Equipment Design (4)

EGR XXX New Market Creation and Entrepreneurial Engineering (3)

EGR XXX Patent and Engineering Law (3)

EGR XXX Business Planning and Feasibility Analysis (4)

EGR XXX Biomechanical Assistive Robotics (3)

EGR XXX Human-Machine Cooperative Systems (3)

EGR XXX Inclusive Systems (4)

Potential engineering concentrations to be developed after faculty hires:

Sustainability Engineering – The development of sustainable devices and systems as well as the modification of existing systems to be more sustainable span engineering disciplines. Students in this concentration will gain knowledge and experience of not only working across disciplines but also collaborating with other professionals and practitioners. Upon graduation, students following this concentration could be attractive recruits to industry, government agencies, or NGOs. This background will also be appropriate for post-baccalaureate study in law or public policy. For example, the sustainability engineering concentration might focus on the design of carbon neutral and carbon negative systems and technologies. Adjacent Illinois State University programs include Sustainable and Renewable Energy, which may provide points of contact for concentration faculty including potential collaborators.

Agricultural Engineering – Technology is having an increasing impact in all aspects of agriculture from the use of AI and bioengineering in crop development to automated agriculture and farming to strengthened supply chain systems. Engineers are in demand not only in equipment design and manufacturing but also in regulation and policy. Familiarity with the application of engineering in agriculture could make graduates in this concentration attractive recruits to entities involved in products, services, and regulation. For example, the agricultural engineering concentration might focus on the design of agricultural mechatronics and systems that reduce resource use and promote sustainable land management.

Engineering Entrepreneurship – Many entrepreneurs have engineering backgrounds, even though traditional disciplinary engineering education (e.g., electrical or mechanical engineering) does not usually include entrepreneurial thinking as a core learning objective. The goal of the engineering entrepreneurship concentration would be to foster students' entrepreneurial spirit and empower these dreamers to become doers. Bridging engineering practice with project management, new venture creation, financing business startups, and social entrepreneurship would allow students to learn from real-world applications through an interdisciplinary perspective. Questioning the status quo, seeking growth and understanding, and embracing opportunities prepares engineers on how to enter the marketplace and improve the world by creating and selling their own products and services. This background will be of value to students starting their own ventures or as new hires applying their knowledge and experience to catalyze innovation in existing profit and non-profit enterprises.

Assistive Technologies Engineering – This background will be of value to students starting their own ventures or as new hires applying their knowledge and experience to catalyze innovation in existing profit and non-profit enterprises. For example, the assistive technologies engineering concentration might focus on the design of technologies that improve access for individuals with auditory, visual, or mobility constraints. Interdisciplinary opportunities at Illinois State University exist with communications sciences and disorders, kinesiology and recreation, occupational safety and health, and nursing.

8. Anticipated funding needs and source of funds.

Funding needs are expected to be minimal beyond what is necessary for the Mechanical and Electrical Engineering majors. Beyond these courses, typical funding associated with student recruitment and advisement, instructional technology support, website design and development, etc. are anticipated.

9. No Does this program count for teacher education?

10. No Is this an Interdisciplinary Studies program?

11. The following questions must be answered.

Yes Have you confirmed that Milner Library has sufficient resources for the proposed program?

Yes Are more than 120 hours required to complete a degree with this major?

Provide a rationale for why this program is over 120 hours.

ABET-accredited engineering programs require a minimum 45 hours of engineering credits and 30 hours of mathematics and natural science credits. These necessitate more than 66 hours required for the major. In both cases, two courses of "buffer" are built into the program in the event that courses that are being counted as engineering credits are deemed by ABET to contain sufficient engineering content to fulfill the 66 hours. These considerations, along with ISU's general education requirements, have pushed the degree program to 122 credits, which has been deemed allowable by the AVP for Undergraduate Education.

Yes Beyond General Education, does the major require more than 66 semester hours?

Rationale for mandating over 66 hours in the major. [Required Hours Policy](#)

ABET-accredited engineering programs require at minimum 45 hours of engineering credits and 30 hours of mathematics and natural science credits. These necessitate more than 66 hours required for the major. In both cases, two courses of "buffer" are built into the program in the event that courses that are being counted as engineering credits are deemed by ABET to contain sufficient engineering content to fulfill the 66 hours.

Yes Does this B.A., B.S., B.S.Ed. require more than 55 semester hours of major courses?

No Does this program stipulate specific general education courses offered in the major department/school as a part of the major requirements only if such courses serve as prerequisites for other courses required by the major?

Yes Does this program stipulate specific course requirements (majors/sequences only) that also satisfy general education and/or IAI requirements?

Please specify those courses below.

Requirements that also fulfill General Education:

MAT 145 – Mathematics
 MAT 146 – Quantitative Reasoning
 PHY 110 – Natural Science 1
 CHE 140 – Natural Science 2

Requirements that also fulfill IAI:

MAT 145 – M1 900-1
 MAT 146 – M1 900-2
 MAT 147 – M1 900-3
 CHE 140 – CHM 911
 PHY 110 – P2 900
 EGR 170 – EGR 931L

No Is the proposed program intended to be longer than four years (as indicated by the plan of study)?

Yes Have letter(s) of concurrence from affected departments/schools been obtained?
A departments/school is affected if it has a program with significant overlap or if it teaches a required or elective course in the program.

12. Routing and action summary for New Program:

1. Engineering Department Curriculum Committee Chair

<u><i>Rebekka Darner (website)</i></u>	<u>Rebekka Darner</u>	<u>2/13/2023 11:13:47 AM</u>
Signature	Print	Date

2. Engineering Department Chair/School Director

<u><i>Rebekka Darner (website)</i></u>	<u>Rebekka Darner</u>	<u>2/13/2023 11:18:17 AM</u>
Signature	Print	Date

3. College of Engineering College Curriculum Committee Chair

<u><i>Todd McLoda (website)</i></u>	<u>Todd McLoda</u>	<u>3/7/2023 3:23:08 PM</u>
Signature	Print	Date

4. College of Engineering College Dean

<u><i>Amy Hurd (website)</i></u>	<u>Amy Hurd</u>	<u>3/7/2023 3:30:27 PM</u>
Signature	Print	Date

5. University Curriculum Committee Chair

<u><i>Mary Califf (website)</i></u>	<u>Mary Califf</u>	<u>4/6/2023 1:18:21 PM</u>
Signature	Print	Date

All new programs (majors, minors, sequences) are routed by the U.C.C. to the Academic Senate

Comments

Comments from Version 1 from Rebekka Darner (Department Curriculum Committee Chair):
 add support

Comments from Version 2 from Todd McLoda (College Curriculum Committee Chair):
 Please append the support letter from physics. I am not able to add the letter.