

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

Program Department Engineering-Mechanical
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Title of New Program Mechanical Engineering

Submission Date Tuesday, March 7, 2023
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Version 2 **ID** 400
Proposed Starting Catalog Year 2024-2025

Associated Course Proposal(s):

New Course proposal EGR 100 titled *Engineering Problem-solving Using Calculus I*
 New Course proposal EGR 101 titled *Engineering Problem-solving Using Calculus II*
 New Course proposal EGR 102 titled *Engineering Explorations*
 New Course proposal EGR 102.01 titled *Engineering Explorations for Transfer Students*
 New Course proposal EGR 150 titled *Introduction to Engineering Design*
 New Course proposal EGR 160 titled *Ideation & Prototyping*
 New Course proposal EGR 170 titled *Analog & Digital Circuits*
 New Course proposal EGR 200 titled *Projects in Electrical and Mechanical Integration*
 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 MAT 148 titled *Calculus III for Engineers & Applied Scientists*
 New Course proposal MAT 149 titled *Engineering Mathematics*
 New Course proposal MEC 195 titled *Engineering Mechanics with Applications*
 New Course proposal MEC 205 titled *Mechanical & Electro-mechanical Analysis & Design*
 New Course proposal MEC 207 titled *Mechanical Prototyping*
 New Course proposal MEC 215 titled *Thermal Fluids Engineering*
 New Course proposal MEC 220 titled *Strength of Materials*
 New Course proposal MEC 316 titled *Computer-Aided Engineering of Mechanical & Thermal Systems*
 New Course proposal MEC 321 titled *Control Systems*
 New Course proposal MEC 322 titled *Vibration Analysis & Control*
 New Course proposal MEC 331 titled *Computer-Integrated Manufacturing*
 New Course proposal MEC 332 titled *Energy Engineering & Power Production Systems*
 New Course proposal MEC 333 titled *Biomechanics & Biomaterials*

1. Proposed Action

- ✓ New Major **Major CIP Code** 14.1901
 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.

Major Requirements**Minimum required credit hours: 98**

- EGR 100
- EGR 101
- EGR 102
- EGR 150
- EGR 155
- EGR 160
- EGR 170
- EGR 200
- EGR 395
- EGR 396
- MEC 195
- MEC 205
- MEC 207
- MEC 215
- MAT 145
- MAT 146
- MAT 148
- MAT 149
- MAT 252
- MAT 260
- IT 166
- PHY 110
- PHY 111
- PHY 112
- CHE 140

Take two of the following (minimum 8 credit hours):

- EGR 310
- MEC 331
- MEC 332
- MEC 333

Take two of the following (minimum 6 credit hours):

- MEC 220
- MEC 316
- MEC 321
- MEC 322

3. Provide a description for the proposed program.

Mechanical Engineering is one of the broadest engineering disciplines and is central to many new technological developments. Mechanical engineers analyze their work using the principles of motion, energy, and force—ensuring that designs function safely, efficiently, and reliably, all at a competitive cost. Engagement in engineering practices and problem-solving begins early in the degree program, concurrent with foundational mathematics and science courses to build theoretical knowledge necessary for developing the advanced knowledge and creative mindset associated with professional practice. Once Mathematics, natural sciences, and engineering design fundamentals sequences are completed, students complete their degree with a set of topic courses across the mechanical engineering discipline as well as specialized focused concentration courses. Students in this program study the forces and interactions between objects, both solid and fluid. They learn the principles of energy transfer, and how to apply these principles to solve practical engineering problems and design engineering solutions to fit a wide variety of situations. Distinguishing characteristics of the ISU BSME program are 1) the program features a multidisciplinary approach that involves an individual or team integrating and synthesizing knowledge from across a variety of disciplines to bridge the gap between academia and industry 2) focuses on equitable and inclusive practices that train ethical engineers to design with empathy and keep justice in mind, and 3) an integration of information literacy throughout the curriculum, resulting in engineers that think and evaluate information critically within and beyond their mechanical engineering discipline.

4. Provide a rationale of proposed program.

Demand for engineering professions is high in Illinois and the six surrounding states. Demand for electrical engineers is projected to grow by 3.8% in Illinois and 3.3% nationally by 2028, compared to the previous decade, with a national median annual income of \$103,390 (Illinois Department of Employment Security, Long-Term Occupational Projections [2018-2028], accessed from: <https://www2.illinois.gov/ides/lmi/pages/employmentprojections.aspx>; Bureau of Labor Statistics, U.S. Department of Labor, Employment Projections, accessed from <https://www.bls.gov/emp/tables/emp-by-major-occupational-group.htm>). Current and projected need for both electrical and mechanical engineers in the state is significant. The proposed degree will not only provide an innovative and rigorous electrical engineering program of study but also the integration of electrical and mechanical engineering principles and a strong background in design. The proposed College degree programs will increase both the number of Illinois residents attaining a degree and the number of high-quality post-secondary credentials available to meet demand, especially since some qualified high school graduates may choose to leave Illinois if they are not accepted into the engineering program of their choice. Providing these additional opportunities may help curb ongoing emigration and meet the growing needs of local industries and engineering firms. Finally, the intentional focus on equity, diversity, and inclusion will allow Illinois State University to effectively serve students who are traditionally underrepresented and underserved in engineering programs. This focus is enacted by connecting to authentic contexts that are relevant to students, teaching teamwork skills and utilizing team-based learning, and emphasizing engineering ethics and designing with empathy and integrity.

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, 42% (~55) of which will be Electrical Engineering majors. A steady-state goal is about 520 students across all three programs, with about 220 of them being Electrical 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)

*A decimalized version of this course is being developed for engineering majors.

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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 (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 (General Education) (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)

General education course (3)

AMALI General Education course (3)

Third Year - Fall Semester (17 credit hours)

PHY 112 (4)

MAT 252 (3)

MEC 195 (4)

MEC 205 (3)

EGR 200 (3)

Third Year - Spring Semester (13 credit hours)

MAT 260 (4)

MEC 207 (3)

MEC 215 (3)

IDEAS General Education course (3)

Fourth Year - Fall Semester (17 credit hours)

General Education course (3)

General Education course (3)

EGR 395 (4)

EGR 310 or MEC 331, 332, or 333 (4)

MEC 220, 316 or 321 (3)

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

EGR 396 (4)

EGR 310 or MEC 331, 332, or 333 (4)

MEC 220, 316, 321 (3) or 322 (4)

General Education course (3)

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 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 310: Robotics & Automation (4)

New mechanical engineering courses developed for this degree program:

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 developed for this degree program:

MAT 148: Calculus III for Engineers (4)

MAT 149: Engineering Mathematics (3)

8. Anticipated funding needs and source of funds.

See financial summary presented to Academic Senate.

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.

General Education Requirements:

MAT 145 – Mathematics

MAT 146 – Quantitative Reasoning

PHY 110 – Natural Science 1

CHE 140 – Natural Science 2

IAI Program Requirements:

MAT 145 – M1 900-1

MAT 146 – M1 900-2

MAT 147 – M1 900-3

CHE 140 – CHM 911

PHY 110 – P2 900

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-Mechanical Department Curriculum Committee Chair

<u>Rebekka Darner (website)</u>	<u>Rebekka Darner</u>	<u>1/21/2023 12:19:22 PM</u>
Signature	Print	Date

2. Engineering-Mechanical Department Chair/School Director

<u>Rebekka Darner (website)</u>	<u>Rebekka Darner</u>	<u>1/21/2023 12:20:07 PM</u>
Signature	Print	Date

3. College of Engineering College Curriculum Committee Chair

<u>Todd McLoda (website)</u>	<u>Todd McLoda</u>	<u>3/7/2023 3:23:32 PM</u>
Signature	Print	Date

4. College of Engineering College Dean

<u>Amy Hurd (website)</u>	<u>Amy Hurd</u>	<u>3/7/2023 3:28:31 PM</u>
Signature	Print	Date

5. University Curriculum Committee Chair

<u>Mary Califf (website)</u>	<u>Mary Califf</u>	<u>4/6/2023 1:18:04 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 Todd McLoda (College Curriculum Committee Chair):

Please append the support letter from physics.

