Contact: Rachel Boon

REQUEST FOR NEW PROGRAM AT THE UNIVERSITY OF NORTHERN IOWA: BACHELOR OF SCIENCE IN MATERIALS SCIENCE & ENGINEERING

Action Requested: Consider approval of the request by the University of Northern Iowa for a Bachelor of Science in Materials Science & Engineering in the College of Humanities, Arts & Sciences.

The Council of Provosts and Board office support approval of this program.

Description of proposed program. The Bachelor of Science (BS) in Materials Science & Engineering is an outgrowth of existing Applied Engineering (formerly Technology) programs, which are well known across the state and have been highly successful over many decades. The new program also takes advantage of existing faculty expertise in materials science in the Chemistry & Biochemistry and Physics Departments. The program emphasizes the properties of metals, which is a core strength of the Department of Applied Engineering & Technical Management. The new major requires 90 credit hours, including 47 credit hours that constitute the materials science and engineering core. The remaining 43 credit hours comprise 31 credit hours of math, chemistry and physics foundational courses and 12 credit hours of technical electives. The materials engineering courses in the core will be taught by UNI faculty members with Ph.D. degrees in engineering.

Academic objectives. The objectives of the B.S. in Materials Science & Engineering program are:

- Provide an education in materials science & engineering consistent with the highest ABET (formerly Accreditation Board for Engineering and Technology) EAC (Engineering Accreditation Commission) accreditation standards;
- Prepare students to understand fundamental engineering principles with high-quality courses in mathematics, chemistry and physics;
- Provide rigorous courses in materials science and engineering that incorporate discussion of underlying physical and chemical principles as well as applications relevant to current and future industries;
- Engage students in laboratory activities and project work to ensure that they obtain practical and direct experience with engineering design and practice;
- Enhance technical writing skills through detailed reports adhering to professional styles and standards.

Need for program. UNI has a strong program in manufacturing engineering technology that prepares students for a wide variety of engineering-related careers in industry. The equipment, infrastructure and personnel necessary for an engineering program are already present, and the renovation of the applied engineering building will enhance facilities. Prospective students who are interested in engineering and also attracted to UNI's undergraduate-centered educational environment must go elsewhere because of the lack of an engineering program. In addition, a survey of materials engineering-related employers in Iowa conducted in spring 2022 indicated a high level of interest in graduates of a materials science & engineering program. It should also be noted that the U.S. Bureau of Labor Statistics (BLS) forecasts that materials engineering-related jobs will grow by 6% over the next decade. Given the increased emphasis on clean energy, national security, and biomedicine, the need for advanced materials and the workers to design and produce them will likely increase significantly over the next 10-15 years, and the BLS growth rate is probably an underestimate. The U.S. government has signaled the importance of advanced

materials development through the Materials Genome Initiative, which is a multi-agency initiative for discovering, manufacturing and deploying advanced materials.

Relationship to existing programs at the institution. The BS in Materials Science & Engineering builds on the existing expertise and facilities UNI has in metal casting and manufacturing technology in the Applied Engineering and Technical Management Department and materials science in the Physics Department and Chemistry and Biochemistry Department. There is currently no major in materials science and no engineering program at UNI. Thus, the proposed program will not duplicate any other current program at UNI.

Relationship to existing programs at other colleges and universities. There is only one materials science & engineering programs in Iowa, the undergraduate materials engineering program at Iowa State University. UNI representatives had an informational meeting with Dr. Peter Collins, Associate Chair of the Iowa State University Materials Science & Engineering Department on November 7, 2022. This information was subsequently shared with Dean Easterling. Dr. Collins (associate chair of MS&E department) praised UNI's metal casting program and attested to the suitable conventionality of the proposed UNI program. He also raised the issue of recruitment and the potential pool of students. Dean Easterling emphasized the established excellence of ISU's MS&E programs and the opportunity to recruit graduate students from UNI's new undergraduate program.

UNI representatives also had an informational meeting with University of Iowa Associate Dean of Engineering Dr. Nicole Grosland on November 8, 2022. This information was subsequently shared with Dean Nembhard. Feedback from the University of Iowa consisted of minor clarifications about the technical electives in the program.

Resources to establish a high-quality program. UNI has the existing faculty expertise and experience to teach all of the courses in the program. However, if enrollment is strong there will be a need for additional faculty in the Applied Engineering and Technical Management, Chemistry and Biochemistry, and Physics Departments so that sufficient faculty are available to teach the additional students in the engineering courses and to meet additional demand in the science and mathematics courses.

Existing facilities and equipment are sufficient to initiate the program. For example electron microscopes, magnetic measurements, metal casting and fabrication facilities, chemical analysis instrumentation and a computer cluster. As the number of students in the program grows, additional equipment and supplies will be needed to maintain the high quality of instruction by providing the larger number of students ready access to equipment and instrumentation.

Materials and supplies will be needed for the laboratory courses in the program and the new team-project based Introduction to Engineering course. There will also be a need for software licenses for the computational software needed for the new computational materials science course.

UNI has the Metal Casting Center which has excellent facilities for materials preparation and characterization. The Foundry 4.0 Center housed within TechWorks is also part of the university. The new program is designed to utilize the existing expertise in metal materials to provide a distinctive education that will meet the workforce needs of the state of Iowa and industry across the nation. The faculty expertise in materials science in the Physics Department and Chemistry and Biochemistry Department will provide an interdisciplinary perspective that will prepare students to excel in different materials engineering environments.

Student demand. The departments expect the demand for new materials to increase beyond current predictions to meet the needs of industries involving clean energy, national security, and biomedicine over the next two decades. Thus, student demand will likely be modest initially, driven by the needs of local and regional manufacturing firms. Demand should increase considerably over the longer term as more manufacturing capacity shifts back to the U.S. and as clean energy and other future-oriented industries become more dominant. It is anticipated that a fraction of the students who would have enrolled in the existing manufacturing engineering technology program will instead enroll in the new engineering program. Given the very receptive response of employers to the proposed program, new students who are interested in enrolling in engineering programs will be attracted to this program. Additionally, community college students with associate degrees (especially AS degrees) will be attracted to the new program.

Workforce need/demand. Engineers are retiring at an increasing rate nationwide due to the aging of the workforce. Increased capacity for training new people to fill these positions is needed. U.S. Bureau of Labor Statistics (BLS) forecasts that materials engineering-related jobs will grow by 6% nationally over the next decade (2021–31), which is the average growth for all professions. UNI expects that this growth will increase because of future demand for clean energy and national security-related technologies.

Advisory Board members for the Applied Engineering & Technical Management Department were surveyed before the creation of the proposed program. The board members are employees of industry partners in Iowa. Respondents were very supportive of a new materials science & engineering program that emphasizes metals and metallurgy. They indicated that there is a need for engineers with skills in these areas. They also indicated that internship opportunities should be available at several local metals-focused manufacturing and processing firms.

Funding and Cost. The major equipment needed to start the program is already in place. Departmental and college reallocations will allow the necessary supplies to be purchased. The College expects to apply to funding sources such as the Roy J. Carver Charitable Trust for funding for additional major equipment after the proposed program has begun admitting students.

Projected student enrollment.

	Y1	Y 2	Y3	Y4	Y5
Undergraduate	10	20	30	40	50

Accreditation. The program will apply for accreditation under ABET. Once the program has graduated a student it can apply for accreditation.

Date of implementation. Fall 2023.

Letters of Support

IOWA | IOWA STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY | UNI University of Northern Iowa

May 22, 2023

To the Board of Regents:

The Council of Provosts discussed the University of Northern Iowa proposal for a Bachelor of Science in Materials Science & Engineering and reviewed associated documentation. There is sufficient evidence for the benefits of this program the University of Northern Iowa, as well as workforce benefit in the state of Iowa and throughout the Midwest. It is an outgrowth of an existing Applied Engineering program and relies on the expertise of existing faculty in Chemistry & Biochemistry and Physics departments. The plan indicates due diligence, significant engagement with employers and stakeholders at other Iowa universities. Based on the evidence and documentation, this program is likely to benefit the University of Northern Iowa and the state of Iowa.

The Council of Provosts is supportive of the program and wishes UNI the best in its implementation.

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