SPECIAL REPORT

OF THE

ACADEMIC MATTERS, GRADUATE
and PROGRAM AND BUDGET COUNCILS

concerning

CREATION OF AN ACCELERATED MASTER OF SCIENCE
DEGREE IN MATERIALS SCIENCE AND ENGINEERING
(#8417)

Presented at the
817th Regular Meeting of the Faculty Senate
November 17, 2022

COUNCIL MEMBERSHIP

ACADEMIC MATTERS COUNCIL
Carolyn Bassett, Bryan Beck, William Brown, Allison Butler, Marcy Clark, Elizabeth Conner, Morgan Donovan-Hall, Sharon Dormier, Laura Francis, Janet Fink, Kate Green, Keisha Green, Farshid Hajir, Mark Liberatore, Linda Lowry, Andrea Malaguti, Anthony Paik, Raymond Rennerd, Jennifer Randall, Caleb Rounds, Sylvia Salas, Tigran Sedrakyn, Barry Spence, Patrick Sullivan, Laura Vandenberg, Jack Wileden

ACADEMIC MATTERS COUNCIL RECOMMENDATION
The Academic Matters Council recommends approval of this proposal

GRADUATE COUNCIL
Evelyn Ashley, Joseph Black, Ana Caicedo, Robert DeConto, Jennifer Friedman, Traci Hess, Alexandra Jesse, Neal Katz, Bernhard Leidner, Robert Maloy, Anthony Paik, Sarah Pfatteicher, Sarah Poissant, Darrel Ramsey-Musolf, Rebecca Reznik-Zellen, Memnun Seven, Patrick Sullivan, Corine Tachtiris, Jacqueline Urla, Tilman Wolf

GRADUATE COUNCIL RECOMMENDATION
The Graduate Council recommends approval of this proposal.

PROGRAM AND BUDGET COUNCIL
Zlatan Aksamija, Jeremiah Bentley, Kathleen Berry, William Brown, Elizabeth Chang, Rosemary Cowell, Sarah Goff, Deborah Gould, Moira Inghilleri, Yoon Ju Kang, Andrew Mangels, Lynn McKenna, Anthony Paik, Alexander Phillips, Anurag Sharma, Gregory Spiridopoulos, Gabriela Weaver, Lisa Wegiel

PROGRAM AND BUDGET COUNCIL RECOMMENDATION
The Program and Budget Council recommends approval of this proposal.
I. Accelerated Masters Program

1. Title: Accelerated Master of Science in Materials Science and Engineering
   (linked to proposal #7537)

2. Proposed Starting Date: 2023-01-01

II. Proposal Development

A. Briefly describe the Proposal

Building upon the recently approved Interdisciplinary Graduate Program (IDGP) in Materials Science and Engineering (MSE), offering M.S. and Ph.D. degrees, we are proposing an accelerated Masters degree in MSE. The proposed accelerated M.S. degree was envisioned and presented as an important component of the new MSE IDGP in the original program proposal and, with final approval of the MSE IDGP having been granted by the Massachusetts Department of Higher Education in Spring 2022, we are now seeking formal approval of the accelerated M.S. degree from the UMass Amherst Faculty Senate. The accelerated M.S. degree will allow for direct admission (criteria described below) of selected undergraduate STEM students at UMass Amherst and Five Colleges and enable them to earn an M.S. in MSE over the course of one additional year. Students graduating from this program will also have the option to gain industry experience and/or take engineering management classes to strengthen the application of their education, as well as to continue to the Ph.D. program.

B. Provide a brief overview of the process for developing the proposal.

The proposal for an IDGP in MSE, offering M.S. and Ph.D. degrees, was developed by a cross-college faculty task force starting in 2019, building on discussions over several years, and with strong support from the Provost and Chancellor. The task force was appointed by Sanjay Raman, Dean of the College of Engineering (COE), in close consultation with Tricia Serio, Dean of the College of Natural Sciences (CNS), and chaired by Ashwin Ramasubramaniam (Professor, Mechanical & Industrial Engineering). The task force consisted of faculty from all departments represented in the IDGP, namely, the Departments of Biomedical Engineering, Chemical Engineering, Civil & Environmental Engineering, Electrical & Computer Engineering, and Mechanical & Industrial Engineering from COE, as well as the Departments of Chemistry and Physics from CNS. The current accelerated M.S. proposal is a continuation of that effort and has been developed by the MSE IDGP Steering Committee, consisting of faculty members from the participating IDGP departments, and appointed by Deans Raman and Serio for the 2021-2022 academic year. This proposal has been reviewed by the COE and CNS Deans.

Purpose and Goals

Describe the proposal's purpose and the particular knowledge and skills to be acquired and provide a rationale for creating this accelerated degree program.

Modeled along the lines of the Accreditation Board for Engineering and Technology (ABET) criteria the objectives of the MSE IDGP are to prepare graduates to:
1. Apply advanced sciences (such as chemistry, biology, and physics), computational techniques, and engineering principles to materials systems;

2. Integrate the understanding of the scientific and engineering principles underlying the four major elements of the field: structure, properties, processing, and performance related to materials systems; and

3. Apply, integrate, and expand knowledge from each of the above four elements of the field using experimental, computational, and statistical methods to solve materials problems including selection and design, as well as to develop new materials and processes and enable innovative materials technologies.

The faculty affiliated with the IDGP (nearly 50 faculty members between COE and CNS) have extensive research and teaching expertise in MSE and MSE is already recognized as a major research strength of UMass Amherst (ranked 36th nationally by U.S. News & World Report in 2021). The University has also made significant investments in state-of-the-art shared facilities and research laboratories in the Life Science Laboratories (Institute for Applied Life Sciences), the Physical Sciences Building, and the Conte National Center for Polymer Research. Under the mentorship of MSE faculty and instructors, students in the proposed IDGP will pursue coursework, obtain equipment and instrumentation training from dedicated staff, and perform original research at the forefront of MSE in these modern, cutting-edge research laboratories and shared facilities. The MSE IDGP is, therefore, well positioned to impart high-quality training to students and enable their success in a variety of career roles spanning industry, academia, and government.

Complementing knowledge and skills acquired through research experience, students can also engage in experiential learning through internships and independent studies. The MSE IDGP is designed to allow students to take up to three credits of practicum (independent study or industrial internship) working with a faculty advisor or an industrial partner to strengthen the application of their education in MSE research or practice. Students can also take up to six credits of Engineering Management courses (offered by COE in collaboration with the Isenberg School of Management) with the aim of enhancing their professional preparation for a career in the materials industry.

Specifically, the accelerated M.S. program aims to create a pipeline of highly talented and motivated STEM students seeking to acquire high-quality education and training in MSE. Although UMass Amherst does not offer a formal undergraduate degree in MSE, there are numerous excellent undergraduate students who gain research experience in MSE PIs’ laboratories, write senior theses on MSE-related research topics, take additional MSE courses (15 credits counted as technical electives) to earn an undergraduate certificate in Materials Engineering, enroll in MSE graduate programs outside of UMass Amherst, and pursue successful careers in MSE research and industrial practice. The accelerated M.S. program will further prepare such motivated students for graduate studies and/or a career in MSE, generate a UMass Amherst alumni base of successful professionals in MSE research and practice, and help UMass Amherst become the “destination of choice” for undergraduate students whose broad career interests lie in areas of MSE. Furthermore, since the IDGP will be largely self-supporting after initial strategic investments from the Provost, a healthy accelerated M.S. program is particularly
important to the IDGP’s revenue stream, as detailed in the budget submitted with the original IDGP proposal (see attachments).

III. Accelerated Masters Information

Does the accelerated master's option apply to all master's degrees in this field, or only to certain tracks or concentrations?

The accelerated M.S. option applies to the thesis and non-thesis M.S. degree options offered through the MSE IDGP.

What type of degree program does this accelerated master's option pertain to?

Note: second and third require separate approval.

An existing degree

Comments: Note: Final approval of the M.S. degree is pending as of now (Feb 2022) with the Massachusetts Department of Higher Education (DHE). In consultation with the Faculty Senate Secretary, this proposal is being submitted for review by the senate committees, anticipating imminent approval from the DHE. This new proposal is linked to proposal #7537.

Describe the projected course sequence for this degree and the timeline to completion for students.

Students will require 32 credits for satisfactory completion of the accelerated M.S. degree. Coursework will consist of four three-credit core courses and six three-credit electives for a total of 30 credits. Two of the six electives should be chosen to attain further specialization in a sub-field of MSE (e.g., advanced manufacturing, biomaterials, electronic materials, etc.); of the four remaining electives, students may take up to two Engineering Management courses and up to one practicum course (MSE-related industry internship or an independent study with MSE-affiliated faculty) for three credits. Attendance at the MSE research seminar series will be mandatory for earning two credits (one credit per semester of residence).

To help accelerate progress towards the M.S. degree, up to twelve credits of graduate level coursework (from the list of approved MSE classes; see attachment) taken during a student's undergraduate degree can be transferred directly to the M.S. degree. The student may use up to six of those credits (i.e., two courses) to satisfy degree requirements in both their bachelors and graduate programs. These “double counted” courses will be from the list of MSE-approved classes (500-level and higher). No more than six credits of coursework taken towards the undergraduate Materials Engineering Certificate program can be transferred to the M.S. degree; furthermore, these six credits must be earned in two of the four core MSE courses—MSE 601, MIE611/CHEM-ENG 697C, MIE 609, and ECE 618 (see below). By transferring some or all of these coursework credits taken during the student's undergraduate degree, completion of the M.S. degree in one year after the undergraduate senior year is much more feasible. Additionally, a student may take up to three credits of practicum over the summer after their senior year (independent study or industrial internship) working with a faculty advisor or an industrial partner and up to six credits of Engineering Management courses several of which are offered
over the summer.

A potential sequence of courses for an accelerated M.S. student would be as follows:

Senior Year (credits double-counted):
MSE 601: Thermodynamics and Kinetics of Materials (3 credits)
MIE 611: Advanced Materials Characterization (3 credits)
OR
CHEM-ENG 697C: Advanced Materials Characterization: Spectroscopy (3 credits)

Summer (optional; courses can be taken in Fall/Spring semesters):
MSE Practicum (3 credits) + One Engineering Management Elective (3 credits)
OR
Two Engineering Management Electives (2 x 3 credits)

Fall:
MIE 609: Mechanical Behavior of Materials (3 credits)
Two MSE Electives (2 x 3 credits)
MSE 691: Research Seminar (1 credit)
Additional MSE Elective (if necessary; 3 credits)

Spring:
ECE 618: Electronic, Optical, and Magnetic Properties of Materials (3 credits)
Two MSE Electives (2 x 3 credits)
MSE 691: Research Seminar (1 credit)
Additional MSE Elective (if necessary; 3 credits)

Students in the accelerated M.S. program will take four core courses—MSE 601, MIE611/CHEM-ENG 697C, MIE 609, and ECE 618—that are required of all graduate students (M.S. and Ph.D.) in the MSE program. These core courses treat materials principles from a fundamental, general perspective applicable to all materials classes rather than addressing a specific materials class and are designed to provide the student with a rigorous background in the fundamental subject matter that will be built upon through elective courses, laboratory training, and research. While maintaining academic rigor, the curriculum builds in sufficient flexibility so that students seeking a career in the materials industry can enhance their professional preparation by replacing up to six credits of electives (two 3-credit courses) with practicum and engineering management classes.

*What undergraduate degree program is this accelerated masters associated with, if any.*
None

*If this proposal requires no additional resources, say so and briefly explain why. If this proposal requires additional resources, explain how they will be paid for. For proposals involving instruction,*
indicate how many new enrollments are expected and whether the courses have room to accommodate them.

The proposed accelerated M.S. program requires no additional resources as it is part of the newly established M.S. degree in MSE. The proposal that established the MSE IDGP (see attachment) already anticipates accelerated M.S. enrollments in the degree enrollments projections with overall M.S. enrollments anticipated at 20 students per year. In the first year or two of the program, we conservatively estimate 3-5 students participating in the accelerated M.S. program because it will be an attractive option to undergraduates with interests in MSE. By engaging UMass STEM students early in their undergraduate career, including several students who already perform research in participating MSE faculty laboratories, we expect that the accelerated M.S. program will attract 8-10 students at its steady state.

Provide the curriculum to the applicable masters degree as it currently appears in the Graduate Bulletin and explain how this curriculum will be scheduled over the student's undergraduate and graduate careers. Note that total number of credits must be 30 plus the minimum number required for undergraduate degree (generally 120, making total number of credits required 150).

Note: For Master's programs under 36 credits, a maximum of 9 graduate-level credits taken as an undergraduate may be applied to both degrees. For Master's programs over 36 credits, a maximum of 12 graduate-level credits taken as an undergraduate may be applied to both degrees.

See curriculum explained above in question about course sequence. The accelerated program is part of a new Interdisciplinary Graduate Program that offers M.S. and Ph.D. degrees in Materials Science and Engineering that was approved recently by the Massachusetts Department of Higher Education.

Who can apply to pursue this accelerated masters degree?
(UMass students, Five College Students, Students in specific degree programs, etc.)

The program is primarily geared towards UMass students in STEM disciplines; Five College Students with the proper background (from STEM disciplines) are also eligible.

Are there any admissions exceptions to this degree program, such as a waiver of the GRE requirements?

Yes
Comments: Waiver of GRE requirements and waiver of letters of recommendations for students with GPAs of 3.5 or higher at the end of their third year. All admissions into the MSE accelerated M.S. program will be contingent upon the students completing their B.S. degree with a cumulative GPA of 3.5 or higher.

MOTION: That the Faculty Senate approve Creation of an Accelerated Master of Science 10-23 Degree in Materials Science and Engineering, as presented in Sen. Doc. No. 23-019.