Program Change Request

New Program Proposal

Date Submitted: 04/10/20 1:10 pm

Viewing: : Aerospace Engineering

Parent Plan: MAJ: Engineering Mechanics MS

Last edit: 05/05/20 3:09 pm

Changes proposed by: csovinec

Name of the school or college academic planner who you consulted with on this proposal.

<table>
<thead>
<tr>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sara Hagen - EGR</td>
</tr>
</tbody>
</table>

In Workflow

1. EGR PHYS Dept. Approver
2. EGR College Admin Reviewer
3. EGR College Approver
4. APIR Admin
5. GFEC Approver
6. UAPC Approver
7. Registrar

Approval Path

1. 12/11/19 2:58 pm
   Carl Sovinec (csovinec):
   Approved for EGR PHYS Dept. Approver
2. 12/11/19 5:12 pm
   Sara Hagen (skhagen):
   Approved for EGR College Admin Reviewer
3. 12/19/19 7:02 pm
   Sara Hagen (skhagen):
   Approved for EGR College Approver
4. 12/30/19 4:26 pm
   Karen Mittelstadt (mittelstadt):
   Rollback to EGR College Approver for APIR Admin
5. 03/16/20 1:15 pm
   Sara Hagen (skhagen): Rollback to Initiator

6. 04/10/20 1:13 pm
   Carl Sovinec (csovinec):
   Approved for EGR PHYS Dept. Approver

7. 04/15/20 3:53 pm
   Sara Hagen (skhagen):
   Approved for EGR College Admin Reviewer

8. 04/15/20 3:59 pm
   Sara Hagen (skhagen):
   Approved for EGR College Approver

9. 04/20/20 9:39 am
   Karen Mittelstadt (mittelstadt):
   Rollback to EGR College Approver for APIR Admin

10. 04/24/20 11:16 am
    Sara Hagen (skhagen):
    Approved for EGR College Approver

11. 04/24/20 3:14 pm
    Karen Mittelstadt (mittelstadt):
    Approved for APIR Admin
Proposal Abstract/Summary:

We are proposing an accelerated named option in Aerospace Engineering for the Engineering Mechanics Master of Science degree. The distinguishing features from the Research named option are that 1) the new program is a coursework-only degree that can be completed in 12 to 16 months and 2) there is an emphasis in aerospace-related topics.

Basic Information

Type of Program: Named Option
Parent Program: MAJ: Engineering Mechanics MS
Parent Audience: Graduate or professional
Parent Home Department: Engineering Physics (EGR PHYS)
Parent School/College: College of Engineering

The program will be governed by the home department/academic unit as specified. Will an additional coordinating or oversight committee be established for the program?

No
Parent is in the Graduate School: Yes

SIS Code:

SIS Description:

Transcript Title: Aerospace Engineering
Named Options:
- 400MSAPMCH: Fndmtls of Applied Mechanics
- 400MSRSRCH: Research
- Sub Plan 1120: No Title Found

Does the parent program offer this as an additional major as well? No

Roles by Responsibility: List one person for each role in the drop down list. Use the green + to create additional boxes.
### List the departments that have a vested interest in this proposal.

<table>
<thead>
<tr>
<th>Departments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Engineering (MECH EGR)</td>
</tr>
<tr>
<td>Material Science &amp; Engineering (MAT SC EGR)</td>
</tr>
<tr>
<td>Civil and Environmental Engr (CIV EN EGR)</td>
</tr>
<tr>
<td>Mathematics (MATH)</td>
</tr>
<tr>
<td>Computer Sciences (COMP SCI)</td>
</tr>
</tbody>
</table>

### Are all program reviews in the home academic unit up to date?
- Yes

### Are all assessment plans in the home academic unit up to date?
- Yes

### Are all assessment reports in the home academic unit up to date?
- Yes

### Mode of Delivery:
- Face-to-Face (majority face-to-face courses)

### Will this program be part of a consortial or collaborative arrangement with another college or university?
- No

### Will instruction take place at a location geographically separate from UW-Madison?
- No

### Parent has outside accreditation:
- No

### Graduates of parent program seek licensure or certification after graduation.
- No

### First term of student enrollment:
- Fall 2021 (1222)

### When will the application for the first term of enrollment open?
- Summer 2020 (1206)
Which terms will you allow new students to enroll? What are the application deadlines for each term selected?

<table>
<thead>
<tr>
<th>Start Term</th>
<th>Application Deadline MM/DD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>12/15</td>
</tr>
<tr>
<td>Spring</td>
<td>10/01</td>
</tr>
</tbody>
</table>

Year of three year check-in to GFEC (3 years after first student enrollment):

2025

Year of first program review (5 years after first student enrollment):

2027

If this proposal is approved, describe the implementation plan and timeline.

The proposed named option is composed of classes that are currently being taught by the Departments of Engineering Physics and Mechanical Engineering. Depending on interest, the EP Department may need to open a second section of the EMA 522 Aerodynamics Laboratory. Enrollment in other courses can, at least initially, be accommodated with existing sections. Thus, academic implementation is essentially "turn-key."

Rationale and Justifications
How does the named option relate to the major and to other named options in the major, if relevant?

The Engineering Physics Department offers an MS degree in the fields of Engineering Mechanics (EM) and in Nuclear Engineering and Engineering Physics (NEEP). The parent plan for the EM MS has been oriented toward research; it has a thesis track and an independent-study track, and a number of these students continue to the PhD program. To accommodate administrative requirements, the parent plan is being moved into the new "Research" named option. The "Aerospace Engineering" named option that is proposed here will focus on getting students through a rigorous masters-level engineering program with minimal interruption to their professional engineering careers. While students in the "Research" option can use the same coursework to satisfy degree requirements, their independent-study, and possible thesis research, requires additional time to complete the MS degree.

The Engineering Physics Department also offers the Fundamentals of Applied Mechanics named option of the EM MS degree. This program is designed to educate students with a non-engineering scientific background in fundamental methods of engineering so that they are equipped to pursue a career in engineering. In contrast, the proposed Aerospace Engineering option is designed for students who have completed undergraduate degrees in engineering and would like to learn advanced topics that will further their careers.

Why is the program being proposed? What is its purpose?

The program is coursework-only graduate education in the engineering mechanics field with particular emphasis on aerospace topics. All students will learn theoretical and computational methods for engineering analysis and take a relevant laboratory class for hands-on experience. The aerospace topics includes fluid mechanics, rigid-body dynamics, structural dynamics, mechanics of aerospace structures. It is not intended to provide the depth of a strict aerospace engineering degree but instead provides a more general mechanics foundation with an aerospace emphasis. Graduates will have a unique combination of skills that will be attractive to industry.

While students in our research-oriented MS will also learn the topics and skills discussed above, the accelerated program will allow the students planning to pursue a career in industry a shorter path to completion. Our intent is to also attract employer interest to fund their engineering employees with a limited time commitment.
Do current students need or want the program? Provide evidence.

There is evidence that current students want the type of accelerated MS program that is proposed here. Considering data that is posted by the College of Engineering Career Services (https://ecs.wisc.edu/students/offers-and-negotiation; see the summary reports in the B.S. Salary Information tab), approximately 1/4 of Engineering Mechanics and Astronautics undergraduates go directly to graduate school. Among those students, we gauge those going into MS programs from the degree recipient data in the MS and PhD Profiles for Engineering Mechanics (see links under https://grad.wisc.edu/academic-programs/?program=G400&type=view) as approximately 75% of those going to graduate school. Furthermore, students from other majors (i.e. Mechanical Engineering, Civil Engineering, etc...) frequently express interest in pursuing an emphasis in Aerospace Engineering in graduate school, and so they provide a large pool of students from which this degree might attract applicants.

Moreover, comparing starting salaries for entry-level positions for those with BS and MS degrees from the ECS data, the MS graduates can expect to earn approximately $12,000 more per year whether using the national MS data from either the Mechanical Engineering or Aerospace Engineering fields.

This program is also designed to be attractive for employer-sponsored continuing education which can be supported by our private sector relationships and especially in-state entities. This program is also seamless to existing undergraduate students wishing to add an additional year to earn an MS degree. This would therefore be a strong option for all students in various tracks of study.
What is the market, workforce, and industry need for this program? Provide evidence.

The aerospace industry is currently ripe with opportunity for several reasons:
- Commercial spaceflight (e.g. SpaceX, Blue Origin) continues to open new employment opportunities for graduate and undergraduate students. The industry is transitioning from one in which the government was the key player to one that is driven commercially. Space access is as important as ever and as the funding landscape evolves new funding opportunities will continue to emerge.
- China and Russia are investing heavily in research in hypersonic aircraft, and this has prompted the U.S. to increase funding in this area. U.S. funding will need to continue to grow dramatically to keep pace with our competitors, and so significant increases are expected.
- Industry has begun to pursue research into supersonic business jets, and several companies anticipate having commercial products in the coming years. The FAA’s restrictions on supersonic flight over land are expected to be relaxed, potentially leading to a resurgence in high speed flight as a major business area. While aircraft were historically designed with large budgets and a reliance on testing, modern aircraft design is driven by simulations and advances in several areas will be needed to develop this next generation of aircraft.
- Sierra-Nevada Corporation has greatly expanded its office and workforce in Middleton, WI, and has hired several of our students.
- Continuing education and MS level employees have long been desirable to private sector employees which prepares them well for leadership roles.

What gap in the program array is it intended to fill?

UW-Madison has long had a well-recognized undergraduate program in Engineering Mechanics and Astronautics (similar to aerospace engineering) and a strong MS program in mechanics that has sent many students to work in industry. This proposal creates an accelerated MS option for students who seek greater depth in aerospace-related topics.

Faculty and Staff Resources

List the core program faculty and staff with title and departmental affiliation(s) who are primarily involved and will participate in the delivery and oversight.

<table>
<thead>
<tr>
<th>Name (Last, First)</th>
<th>Department</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allen, Matt</td>
<td>Engineering Physics (EGR PHYS)</td>
<td>Professor</td>
</tr>
<tr>
<td>Bonazza, Riccardo</td>
<td>Engineering Physics (EGR PHYS)</td>
<td>Professor</td>
</tr>
<tr>
<td>Bronkhorst, Curt</td>
<td>Engineering Physics (EGR PHYS)</td>
<td>Professor</td>
</tr>
<tr>
<td>Choy, Jennifer</td>
<td>Engineering Physics (EGR PHYS)</td>
<td>Assistant Professor</td>
</tr>
</tbody>
</table>
Confirm that the program advisor(s) or coordinator(s) have been consulted and reviewed this proposal.

<table>
<thead>
<tr>
<th>Name (Last, First)</th>
<th>Department</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crone, Wendy</td>
<td>Engineering Physics (EGR PHYS)</td>
<td>Professor</td>
</tr>
<tr>
<td>Franck, Jennifer</td>
<td>Engineering Physics (EGR PHYS)</td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>Lakes, Roderic</td>
<td>Engineering Physics (EGR PHYS)</td>
<td>Professor</td>
</tr>
<tr>
<td>Notbohm, Jacob</td>
<td>Engineering Physics (EGR PHYS)</td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>Thevamaran, Ramathasan</td>
<td>Engineering Physics (EGR PHYS)</td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>Rothamer, David</td>
<td>Mechanical Engineering (MECH EGR)</td>
<td>Associate Professor</td>
</tr>
<tr>
<td>Suresh, Krishnan</td>
<td>Mechanical Engineering (MECH EGR)</td>
<td>Professor</td>
</tr>
<tr>
<td>Franck, Christian</td>
<td>Mechanical Engineering (MECH EGR)</td>
<td>Associate Professor</td>
</tr>
<tr>
<td>Eriten, Melih</td>
<td>Mechanical Engineering (MECH EGR)</td>
<td>Associate Professor</td>
</tr>
<tr>
<td>Thelen, Darryl</td>
<td>Mechanical Engineering (MECH EGR)</td>
<td>Professor</td>
</tr>
<tr>
<td>Trujillo, Mario</td>
<td>Mechanical Engineering (MECH EGR)</td>
<td>Associate Professor</td>
</tr>
<tr>
<td>Zinn, Mike</td>
<td>Mechanical Engineering (MECH EGR)</td>
<td>Associate Professor</td>
</tr>
</tbody>
</table>

What resources are available to support faculty, staff, labs, equipment, etc.? 

As this program of study will offer courses which are currently being offered to graduate students across the COE, it will not require support and resources other than additional funding for faculty and teaching assistants for the additional student workload anticipated and planned.

Program advisor(s) with title and departmental affiliation(s).

<table>
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<tr>
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<td>Allen, Matt</td>
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</tr>
<tr>
<td>Bonazza, Riccardo</td>
<td>Engineering Physics (EGR PHYS)</td>
<td>Professor</td>
</tr>
</tbody>
</table>

Describe how student services and advising will be supported.

As this program of study will offer courses which are currently being offered to graduate students across the COE, this program will be self-supporting through direct funding to the EP Department.

Confirm that the program advisor(s) or coordinator(s) have been consulted and reviewed this proposal.
Resources, Budget, and Finance

Is this a revenue program? Yes

What is the tuition structure for this program?
Market-based tuition - separate proposal to be submitted

Select a tuition increment:
$1,200/credit

What is the rationale for selecting this tuition increment?

Effective Fall 2021, all of the face-to-face 131 programs in the College of Engineering will be $1,200 per credit. Approval documents are attached.

Upload the proposal for market based tuition:
* Market-Based Tuition Proposal Accelerated MS Engineering 3 13 2020.docx
* Market based tuition Accelerated Engr Masters 3 20 2020 Cover.pdf
* Market-basedTuition_AcclEngrMS_APPROVED chancellor and president 3 20 2020.pdf

Provide a summary business plan.

The proposed Aerospace Engineering program relies upon an accelerated curriculum of coursework using existing graduate level courses. This is the basis for the business plan for this proposed program of study which is also meant to minimize the cost involved with this new offering from the EP department.

Provide an overview of plans for funding the program including but not limited to program administration, instructional/curricular delivery, technology needs and program assessment.

As this program of study will offer courses which are currently being offered to graduate students across the COE, this program will be self-supporting through direct funding to the EP Department.
What is the marketing plan?

We will market this proposed program through the Division of Continuing Studies. We anticipate significant enrollment from existing students in Engineering Physics and Mechanical Engineering and expect to attract enough students to keep the program viable with minimal advertising. Marketing expenses are included in the College share of 13.5% in the attached budget.

Does the program or change require substantial new resources other than those just described? Describe the needs. Confirm that the dean is committed to providing the resources.

No substantial new resources will be required. The COE Dean is committed to providing the resources for this program.

Are new Library resources needed to support this program?

No

Describe plans for funding students including but not limited to funding sources and how funding decisions are made.

This named option will include a limited amount of partial scholarship funding. Decisions to offer scholarships will be made by the EP Graduate Studies Committee after reviewing applications and identifying those who have the strongest undergraduate academic records.

Curriculum and Requirements

Parent Plan Admissions/How To Get In Requirements

Students apply to the Master of Science in Engineering Mechanics through one of the named options:

Research
Aerospace Engineering [REGISTRAR add link when available]
Fundamentals of Applied Mechanics
Please consult the table below for key information about this degree program’s admissions requirements. The program may have more detailed admissions requirements, which can be found below the table or on the program’s website.

Graduate admissions is a two-step process between academic programs and the Graduate School. Applicants must meet the minimum requirements of the Graduate School as well as the program(s). Once you have researched the graduate program(s) you are interested in, apply online.

Graduate Admissions Requirements

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Deadline</td>
<td>December 15*</td>
</tr>
<tr>
<td>Spring Deadline</td>
<td>October 1</td>
</tr>
<tr>
<td>Summer Deadline</td>
<td>This program does not admit in Summer.</td>
</tr>
<tr>
<td>GRE (Graduate Record Examinations)</td>
<td>Required.**</td>
</tr>
<tr>
<td>English Proficiency Test</td>
<td>Every applicant whose native language is not English or whose undergraduate instruction was not in English must provide an English proficiency test score and meet the Graduate School minimum requirements (<a href="https://grad.wisc.edu/apply/requirements/#english-proficiency">https://grad.wisc.edu/apply/requirements/#english-proficiency</a>).</td>
</tr>
<tr>
<td>Other Test(s) (e.g., GMAT, MCAT)</td>
<td>n/a</td>
</tr>
<tr>
<td>Letters of Recommendation</td>
<td>3</td>
</tr>
</tbody>
</table>

* Complete applications as of December 15 are guaranteed to be reviewed, but applicants are welcomed up to March 31 and will be reviewed as space is available.

**Except for current UW-Madison NE/EP/EMA undergraduate students.

The Graduate School sets minimum requirements for admissions. Academic program admission requirements are often more rigorous than those set by the Graduate School. Please check the program website for details and admissions deadlines.

Describe plans for recruiting students to this program.

We will recruit students for this program from the existing pool of undergraduate students as well as with in-state and out-of-state employers.

Projected Annual Enrollment:

<table>
<thead>
<tr>
<th>Year</th>
<th>Projected Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>8</td>
</tr>
<tr>
<td>Year</td>
<td>Projected Enrollment</td>
</tr>
<tr>
<td>-------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Year 2</td>
<td>16</td>
</tr>
<tr>
<td>Year 3</td>
<td>28</td>
</tr>
<tr>
<td>Year 4</td>
<td>36</td>
</tr>
<tr>
<td>Year 5</td>
<td>40</td>
</tr>
</tbody>
</table>

Maximum enrollment that can be supported with existing instructional and student services resources: 40

Those who are not familiar with using the html editor fields may upload a document with information about the curriculum for use by those who will format and edit the content that will appear in the Guide.

**Parent Requirements**

Approved Shared Content from /shared/graduate-minimum-degree-requirements-and-satisfactory-progress/

Last Approved: Oct 25, 2018 11:29am

**Minimum Graduate School Requirements**

Review the Graduate School minimum academic progress and degree requirements, in addition to the program requirements listed below.

**Major Requirements**

**CURRICULAR REQUIREMENTS**

University General Education Requirements

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Credit</td>
<td>30 credits</td>
</tr>
<tr>
<td>Requirement</td>
<td></td>
</tr>
<tr>
<td>Minimum Residence</td>
<td>16 credits</td>
</tr>
<tr>
<td>Credit Requirement</td>
<td></td>
</tr>
</tbody>
</table>
Requirements

Minimum Graduate Coursework Requirement
See Named Options for policy information.

Overall Graduate GPA Requirement
3.00 GPA required.

Other Grade Requirements
Courses in which grades of BC, C, or below are received cannot be counted toward the degree except as follows: 1) Credits of C will be allowed provided they are balanced by twice as many credits of A or by four times as many credits of AB, 2) Credits of BC will be allowed provided they are balanced by twice as many credits of AB or by an equal number of credits of A.

Assessments and Examinations
See Named Options for policy information.

Language Requirements
No language requirements.

Required COURSES

Select a Named Option for courses required.

Named Options

A named option is a formally documented sub-major within an academic major program. Named options appear on the transcript with degree conferral. Students pursuing the Master of Science in Engineering Mechanics must select one of the following named options:

View as list

View as grid

Engineering Mechanics: Research, M.S.

Guide Requirements tab

Approved Shared Content from /shared/graduate-minimum-degree-requirements-and-satisfactory-progress/
Last Approved: Oct 25, 2018 11:29am

Minimum Graduate School Requirements

Review the Graduate School minimum academic progress and degree requirements, in addition to the program requirements listed below.

Named Option Requirements

MODE OF INSTRUCTION

<table>
<thead>
<tr>
<th>Mode of Instruction</th>
<th>Face to Face</th>
<th>Evening/Weekend</th>
<th>Online</th>
<th>Hybrid</th>
<th>Accelerated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Mode of Instruction Definitions

Approved Shared Content from /shared/graduate-school-mode-instruction-definitions/
Last Approved: Oct 25, 2018 11:30am

Evening/Weekend: These programs are offered in an evening and/or weekend format to accommodate working schedules. Enjoy the advantages of on-campus courses and personal connections, while keeping your day job. For more information about the meeting schedule of a specific program, contact the program.

Online: These programs are offered primarily online. Many available online programs can be completed almost entirely online with all online programs offering at least 50 percent or more of the program work online. Some online programs have an on-campus component that is often designed to accommodate working schedules. Take advantage of the convenience of online learning while participating in a rich, interactive learning environment. For more information about the online nature of a specific program, contact the program.

Hybrid: These programs have innovative curricula that combine on-campus and online formats. Most hybrid programs are completed on-campus with a partial or completely online semester. For more information about the hybrid schedule of a specific program, contact the program.

Accelerated: These on-campus programs are offered in an accelerated format that allows you to complete your program in a condensed time-frame. Enjoy the advantages of on-campus courses with minimal disruption to your career. For more information about the accelerated nature of a specific program, contact the program.
CURRICULAR REQUIREMENTS

University General Education Requirements

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Credit</td>
<td>30 credits</td>
</tr>
<tr>
<td>Residence Credit Requirement</td>
<td>16 credits</td>
</tr>
<tr>
<td>Minimum Graduate Coursework Requirement</td>
<td>Half of degree coursework must be completed graduate-level coursework; courses with the Graduate Level Coursework attribute are identified and searchable in the university's Course Guide.</td>
</tr>
<tr>
<td>Overall Graduate GPA Requirement</td>
<td>3.00 GPA required.</td>
</tr>
<tr>
<td>Other Grade Requirements</td>
<td>Courses in which grades of BC, C, or below are received cannot be counted toward the degree except as follows: 1) Credits of C will be allowed provided they are balanced by twice as many credits of A or by four times as many credits of AB, 2) Credits of BC will be allowed provided they are balanced by twice as many credits of AB or by an equal number of credits of A.</td>
</tr>
<tr>
<td>Assessments and Examinations</td>
<td>No formal examination required.</td>
</tr>
<tr>
<td>Language Requirements</td>
<td>No language requirements.</td>
</tr>
</tbody>
</table>

Required Courses

Students must take at least one class in EMA at the 700-level or above.

To establish sufficient depth in aerospace sciences, the courses selected must involve completion of at least two of the following five topical areas. You should check the future course offerings plans when choosing, since not all courses are offered every year and hence not all topical areas can be completed every year.

The additional courses required to meet the 30-credit minimum for completion of the degree should be selected from among the courses listed below.

1. These tracks are internal to the program and represent different pathways a student can follow to earn this degree. Track names do not appear in the Graduate School admissions application, and they will not appear on the transcript.

2. Engineering Physics website - Click on "Courses" under "Degree Information"
   Mechanical Engineering website - Click on "Courses" under "Program Details"

TOPICAL AREAS

Fluid Mechanics

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>E M A 521</td>
<td>Aerodynamics 2</td>
<td>3</td>
</tr>
</tbody>
</table>

https://next-guide.wisc.edu/courseleaf/approve/?role=RGE Division Approver
5/6/2020 : Aerospace Engineering

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 563</td>
<td>Intermediate Fluid Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>EM A 524</td>
<td>Rocket Propulsion</td>
<td></td>
</tr>
<tr>
<td>ME 572</td>
<td>Intermediate Gas Dynamics</td>
<td></td>
</tr>
<tr>
<td>ME 775</td>
<td>Turbulent Heat and Momentum Transfer</td>
<td></td>
</tr>
</tbody>
</table>

These tracks are internal to the program and represent different pathways a student can follow to earn this degree. Track names do not appear in the Graduate School admissions application, and they will not appear on the transcript.

If you have already completed an equivalent course as an undergrad then you may take two courses total from the second list and meet this requirement.

### Rigid Body Dynamics

#### Course List

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>E M A 542</td>
<td>Advanced Dynamics 2</td>
<td>3</td>
</tr>
</tbody>
</table>

Select one:

- E M A 523 Flight Dynamics and Control
- E M A/ ASTRON 550 Astrodynamics
- E M A 642 Satellite Dynamics
- ME 451 Kinematics and Dynamics of Machine Systems

These tracks are internal to the program and represent different pathways a student can follow to earn this degree. Track names do not appear in the Graduate School admissions application, and they will not appear on the transcript.

If you have already completed an equivalent course as an undergrad then you may take two courses total from the second list and meet this requirement.

### Structural Dynamics

#### Course List

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 440</td>
<td>Intermediate Vibrations</td>
<td>3</td>
</tr>
<tr>
<td>E M A 545</td>
<td>Mechanical Vibrations</td>
<td></td>
</tr>
<tr>
<td>E C E 717</td>
<td>Linear Systems</td>
<td></td>
</tr>
</tbody>
</table>

Select one:

- ME/E M A 540 Experimental Vibration and Dynamic System Analysis
- E M A 610 Structural Finite Element Model Validation
- E M A 747 Nonlinear and Random Mechanical Vibrations

These tracks are internal to the program and represent different pathways a student can follow to earn this degree. Track names do not appear in the Graduate School admissions application, and they will not appear on the transcript.

If you have already completed an equivalent course as an undergrad then you may take two courses total from the second list and meet this requirement.
Aerospace Mechanics and Materials

Course List

Select two courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>E M A 506</td>
<td>Advanced Mechanics of Materials I</td>
<td>6</td>
</tr>
<tr>
<td>E M A/M S &amp; E 541</td>
<td>Heterogeneous and Multiphase Materials</td>
<td></td>
</tr>
<tr>
<td>E M A/CIV ENGR/M E 508</td>
<td>Composite Materials</td>
<td></td>
</tr>
<tr>
<td>E M A 622</td>
<td>Mechanics of Continua</td>
<td></td>
</tr>
<tr>
<td>E M A 630</td>
<td>Viscoelastic Solids</td>
<td></td>
</tr>
<tr>
<td>E M A 700</td>
<td>Theory of Elasticity</td>
<td></td>
</tr>
<tr>
<td>E M A/M E 703</td>
<td>Plasticity Theory and Physics</td>
<td></td>
</tr>
</tbody>
</table>

1. These tracks are internal to the program and represent different pathways a student can follow to earn this degree. Track names do not appear in the Graduate School admissions application, and they will not appear on the transcript.

Computation

Course List

Select one:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>E M A 605</td>
<td>Introduction to Finite Elements</td>
<td>3</td>
</tr>
<tr>
<td>M E 573</td>
<td>Computational Fluid Dynamics</td>
<td></td>
</tr>
</tbody>
</table>

Select one:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>E M A 705</td>
<td>Advanced Topics in Finite Elements</td>
<td>3</td>
</tr>
<tr>
<td>M E 548</td>
<td>Introduction to Design Optimization</td>
<td></td>
</tr>
<tr>
<td>M E 748</td>
<td>Optimum Design of Mechanical Elements and Systems</td>
<td></td>
</tr>
<tr>
<td>MATH/COMP SCI 714</td>
<td>Methods of Computational Mathematics I</td>
<td></td>
</tr>
<tr>
<td>E M A/COMP SCI/E C E/E P/M E 759</td>
<td>High Performance Computing for Applications in Engineering</td>
<td></td>
</tr>
</tbody>
</table>

1. These tracks are internal to the program and represent different pathways a student can follow to earn this degree. Track names do not appear in the Graduate School admissions application, and they will not appear on the transcript.

2. If you have already completed an equivalent course as an undergrad then you may take two courses total from the second list and meet this requirement.

Fall Semester 13 Credits

Required:

E P/E M A 547 Engineering Analysis I, 3 credits
E M A 601 Special Topics in Engineering Mechanics, 1 credit

Choose 9 additional credits

Spring Semester 13 Credits

Required:

E M A 601 Special Topics in Engineering Mechanics, 1 credit

Choose 12 additional credits

Typical Transfer Credit or 3rd Semester
E M A 506  Advanced Mechanics of Materials I  3
E M A 521  Aerodynamics  3
E M A 524  Rocket Propulsion  3
E M A/M S & E  541  Heterogeneous and Multiphase Materials  3
E M A 605  Introduction to Finite Elements  3
E M A 622  Mechanics of Continua  3
E M A/M  E  703  Plasticity Theory and Physics  3
E P/E M A  547  Engineering Analysis I  3
E M 440  Intermediate Vibrations  3
E M/E M A  540  Experimental Vibration and Dynamic System Analysis  3
E M/E M A  570  Experimental Mechanics  3
E M 573  Computational Fluid Dynamics  3

**Spring Course Offerings:**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>E M A 522</td>
<td>Aerodynamics Lab</td>
<td>3</td>
</tr>
<tr>
<td>E M A 523</td>
<td>Flight Dynamics and Control</td>
<td>3</td>
</tr>
<tr>
<td>E M A/ASTRON  550</td>
<td>Astrodynamics</td>
<td>3</td>
</tr>
<tr>
<td>E M A/M  E  570</td>
<td>Experimental Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>E M A 610</td>
<td>Structural Finite Element Model Validation</td>
<td>3</td>
</tr>
<tr>
<td>E M A 611</td>
<td>Advanced Mechanical Testing of Materials</td>
<td>3</td>
</tr>
<tr>
<td>E M A 630</td>
<td>Viscoelastic Solids</td>
<td>3</td>
</tr>
<tr>
<td>E M A 642</td>
<td>Satellite Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>E M A 705</td>
<td>Advanced Topics in Finite Elements</td>
<td>3</td>
</tr>
<tr>
<td>E M A 747</td>
<td>Nonlinear and Random Mechanical Vibrations</td>
<td>3</td>
</tr>
<tr>
<td>M E 563</td>
<td>Intermediate Fluid Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>M E 569</td>
<td>Applied Combustion</td>
<td>3</td>
</tr>
<tr>
<td>M E 572</td>
<td>Intermediate Gas Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>M E 769</td>
<td>Combustion Processes</td>
<td>3</td>
</tr>
<tr>
<td>M E 775</td>
<td>Turbulent Heat and Momentum Transfer</td>
<td>3</td>
</tr>
</tbody>
</table>

**Fall/Spring Course Offerings (offering varies):**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>E M A 700</td>
<td>Theory of Elasticity</td>
<td>3</td>
</tr>
</tbody>
</table>
### Total credits required:

30

### Parent Plan Graduate Policies

Students should refer to one of the named options for policy information:

- **Research**
  - Aerospace Engineering [REGISTRAR please add link when available]
- **Fundamentals of Applied Mechanics**

Guide Graduate Policies tab

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### Approved Shared Content from /shared/graduate-school-policies/

Last Approved: Oct 25, 2018 11:30am

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### Graduate School Policies

The [Graduate School's Academic Policies and Procedures](#) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree program faculty. Policies set by the academic degree program can be found below.

---

### Named Option-Specific Policies

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 705</td>
<td>Mathematical Fluid Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME/N E 520</td>
<td>Two-Phase Flow and Heat Transfer</td>
<td>3</td>
</tr>
<tr>
<td>ME 545</td>
<td>Fluid Power</td>
<td>3</td>
</tr>
<tr>
<td>ME 561</td>
<td>Intermediate Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME 564</td>
<td>Heat Transfer</td>
<td>3</td>
</tr>
<tr>
<td>ME 761</td>
<td>Topics in Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>ME 764</td>
<td>Advanced Heat Transfer I-Conduction</td>
<td>3</td>
</tr>
<tr>
<td>ME 770</td>
<td>Advanced Experimental Instrumentation</td>
<td>3</td>
</tr>
<tr>
<td>ME 774</td>
<td>Chem Kinetics of Combust Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

---

### Prior Coursework

#### Graduate Work from Other Institutions

No transfer credits are allowed.

#### UW–Madison Undergraduate

With program approval, students are allowed to count up to 7 credits of coursework from the following list of courses:

---

https://next-guide.wisc.edu/courseleaf/approve/?role=RGE Division Approver
### Course List

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>E P/E M A 547</td>
<td>Engineering Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>E P/E M A 548</td>
<td>Engineering Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>E M A 303</td>
<td>Mechanics of Materials</td>
<td>3</td>
</tr>
<tr>
<td>E M A/M E 307</td>
<td>Mechanics of Materials Lab</td>
<td>1</td>
</tr>
<tr>
<td>E M A 405</td>
<td>Practicum in Finite Elements</td>
<td>3</td>
</tr>
<tr>
<td>E M A 405</td>
<td>Practicum in Finite Elements</td>
<td>3</td>
</tr>
<tr>
<td>E M A 506</td>
<td>Advanced Mechanics of Materials I</td>
<td>3</td>
</tr>
<tr>
<td>E M A/CIV ENGR/M E 508</td>
<td>Composite Materials</td>
<td>3</td>
</tr>
<tr>
<td>E M A 519</td>
<td>Fracture Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>E M A 542</td>
<td>Advanced Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>E M A/M E 570</td>
<td>Experimental Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>E M A 605</td>
<td>Introduction to Finite Elements</td>
<td>3</td>
</tr>
<tr>
<td>E M A 611</td>
<td>Advanced Mechanical Testing of Materials</td>
<td>3</td>
</tr>
<tr>
<td>E M A 622</td>
<td>Mechanics of Continua</td>
<td>3</td>
</tr>
<tr>
<td>E M A 642</td>
<td>Satellite Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>E M A 705</td>
<td>Advanced Topics in Finite Elements</td>
<td>3</td>
</tr>
</tbody>
</table>

These may be counted toward the Minimum Graduate Degree Credit Requirement as applicable. No credits may be counted toward the minimum graduate residence credit requirement. Coursework earned five or more years prior to admission to a master's degree is not allowed to satisfy requirements.

**UW–Madison University Special**

With program approval, students are allowed to count up to 15 credits of coursework numbered 400 or above taken as a UW–Madison Special student toward the minimum graduate residence credit requirement, and the minimum graduate degree credit requirement. UW–Madison coursework taken as a University Special student would not be allowed to count toward the 50% graduate coursework minimum unless taken at the 700 level or above. Coursework earned five or more years prior to admission to a master’s is not allowed to satisfy requirements.

**Probation**

A semester GPA below 3.0 will result in the student being placed on academic probation. If a semester GPA of 3.0 is not attained during the subsequent semester of full time enrollment (or 12 credits of enrollment if enrolled part-time) the student may be dismissed from the program or allowed to continue for one additional semester based on advisor appeal to the Graduate School.

**ADVISOR / COMMITTEE**

Each student is required to meet with his or her advisor prior to registration every semester.

**CREDITS PER TERM ALLOWED**

15 credits
Time Constraints

Students are expected to complete the FAM degree program in one calendar year, i.e., 12 months (summer session plus two semesters). One additional semester is permitted to complete the requirements, if needed.

Grievances and Appeals

Approved Shared Content from /shared/graduate-school-grievance-policy/
Last Approved: Apr 14, 2020 3:18pm

These resources may be helpful in addressing your concerns:

- Bias or Hate Reporting
- Graduate Assistantship Policies and Procedures
- Hostile and Intimidating Behavior Policies and Procedures
- Office of the Provost for Faculty and Staff Affairs
- Dean of Students Office (for all students to seek grievance assistance and support)
- Employee Assistance (for personal counseling and workplace consultation around communication and conflict involving graduate assistants and other employees, post-doctoral students, faculty and staff)
- Employee Disability Resource Office (for qualified employees or applicants with disabilities to have equal employment opportunities)
- Graduate School (for informal advice at any level of review and for official appeals of program/departmental or school/college grievance decisions)
- Office of Compliance (for class harassment and discrimination, including sexual harassment and sexual violence)
- Office of Student Conduct and Community Standards (for conflicts involving students)
- Ombuds Office for Faculty and Staff (for employed graduate students and post-docs, as well as faculty and staff)
- Title IX (for concerns about discrimination)

Engineering Mechanics Grievance Procedures

Students who feel that they have been treated unfairly have the right to a prompt hearing of their grievance. Such complaints may involve course grades, classroom treatment, advising, various forms of harassment, or other issues. Any student or potential student may use these procedures.

The student should speak first with the person toward whom the grievance is directed. In most cases, grievances can be resolved at this level.

Should a satisfactory resolution not be achieved, the student should contact the program’s Grievance Advisor to discuss the grievance. The Graduate Student Coordinator can provide students with the name of this faculty member, who facilitates problem resolution through informal channels. The Grievance Advisor is responsible for facilitating any complaints or issues of students. The Grievance Advisor first attempts to help students informally address the grievance prior to any formal complaint. Students are also encouraged to talk with their faculty advisors regarding concerns or difficulties if necessary. University resources for sexual harassment concerns can be found on the UW Office of Equity and Diversity website.

If the issue is not resolved to the student’s satisfaction, the student can submit the grievance to the Grievance Advisor in writing, within 60 calendar days of the alleged unfair treatment.

On receipt of a written complaint, a faculty committee will be convened by the Grievance Advisor to manage the
grievance. The program faculty committee will obtain a written response from the person toward whom the complaint is directed. The response will be shared with the person filing the grievance. The faculty committee will determine a decision regarding the grievance. The Grievance Advisor will report on the action taken by the committee in writing to both the student and the party toward whom the complaint was directed within 15 working days from the date the complaint was received.

At this point, if either party (the student or the person toward whom the grievance is directed) is unsatisfied with the decision of the faculty committee, the party may file a written appeal. Either party has 10 working days to file a written appeal to the College of Engineering.

The Assistant Dean for Graduate Affairs (engr-dean-graduateaffairs@engr.wisc.edu) provides overall leadership for graduate education in the College of Engineering (CoE) and is a point of contact for graduate students who have concerns about education, mentoring, research, or other difficulties.

The Graduate School has procedures for students wishing to appeal a grievance decision made at the college level. These policies are described in the Academic Policies and Procedures at https://grad.wisc.edu/academic-policies/.

Other

Students in the accelerated Fundamentals of Applied Mechanics (M.S.) program are not eligible for graduate assistantships; as it is an accelerated program students are not expected to accommodate time for assistantship work.

Discuss expected progress to degree and time to degree. For undergraduate programs discuss considerations for supporting students to complete the degree in four academic years.

A credit requirement to graduate will be 30. This is achievable within 12-16 months for full-time students and 24 months for part-time students.

Program Learning Outcomes and Assessment

Parent Program
Learning Outcomes

Demonstrate a strong understanding of mathematical, scientific, and engineering principles in the field.

Demonstrate an ability to formulate, analyze, and independently solve advanced engineering problems.

Apply the relevant scientific and technological advancements, techniques, and engineering tools to address these problems.

Recognize and apply principles of ethical and professional conduct.
Summarize the assessment plan.

Data collected by faculty advisors using the Learning Goals checklist will be compiled and summarized by the department’s graduate program assessment coordinator (GPAC) on an annual basis. The GPAC will lead a discussion and review of the data once per year at faculty meeting and report the assessment results, including summary and any recommendations. The Dean's office will compile an annual College-wide summary report consisting of the individual reports and any additional recommendations from the CoE Academic Planning Council. The assessment plan is attached to the parent program in Lumen.

**Commitments**

All required courses are approved through the school/college level.

Yes

Courses are offered on a regular basis to allow timely completion.

Yes

Courses have enrollment capacity.

Yes

Students may complete only 1 named option within a plan code.

Yes

The program faculty/staff will ensure the program website, Advance Your Career materials if applicable, and other presentations are consistent with the Guide information for this program.

Yes

Credential will not be awarded retroactively to students who completed all of the requirements before the credential was approved.

Yes

**Supporting Information**

List name and department of those who are in support of this proposal.
If those supporting the proposal provided a letter or email of support upload here. A letter is NOT required. Upload any other explanatory information about support from other UW-Madison units.

- ME-support-for-aerospace.pdf
- Math and CS support for Aerospace.pdf

Additional Information:

- EM 131 Budget Proposal 04-09-2020 (1).xlsx
- Market based tuition Accelerated Engr Masters 3 20 2020 Cover.pdf

**Approvals**

*Department Approval* - This proposal has been approved by the faculty at the department/academic unit level. The program faculty confirm that the unit has the capacity and resources (financial, physical, instructional, and administrative) to meet the responsibilities associated with offering the program, including offering the necessary courses, advising students, maintaining accurate information about the program in the Guide and elsewhere, conducting student learning assessment and program review, and otherwise attend to all responsibilities related to offering this program.

Enter any notes about approval here:

The Engineering Physics Department reviewed and approved this program proposal at its November 12, 2019 faculty meeting. (entered 12/11/2019)

The Engineering Physics Department reviewed and approved the revised version of this program proposal at its April 7, 2020 faculty meeting.

Entered by: Carl Sovinec 
Date entered: 4/10/2020

*School/College Approval* - This proposal has been approved at the school/college level and it is submitted with the Dean’s support. The Dean and program faculty confirm that the unit has the capacity and resources (financial, physical, instructional, and administrative) to meet the responsibilities associated with offering the program, including offering the necessary courses, advising students, maintaining accurate information about the program in the Guide and elsewhere, conducting student learning assessment and program review, and otherwise attend to all responsibilities related to offering this program.

Enter any notes about approval here:
Approved by the College of Engineering APC on December 18, 2019.
Re-approved by the College of Engineering APC on April 15, 2020.

Entered by and Sara Hagen
Date: Date entered: 04/15/2020

GFEC Approval - This proposal has been approved by the Graduate Faculty Executive Committee and the Dean of the Graduate School.

Enter any notes about the approval here:

Entered by:
Date entered:

UAPC Approval - This proposal has been approved by the University Academic Planning Council and the Provost.

Enter any notes about approval here:

Entered by:
Date entered:

For Administrative Use

Admin Notes:

Guide URL:

Effective date:

SIS Short Description:

Other plan codes associated with this program:

Educational Innovation Program:
Distance Education
Program:

Non Traditional
Program:

Special Plan Type:

Reviewer
Comments

Karen Mittelstadt (mittelstadt) (12/30/19 4:26 pm): Rollback: Rolled back by APIR so ENG could address the following issues/concerns: 1) in Roles by Responsibility, list individuals in all four roles, 2) please answer the question regarding the max enrollment that can be supported. Addtl Note #1: APIR has concerns re. the plan for the informal tracks. With defined curricula by "track," these look more like discrete named options. Mittelstadt will follow up with Hagen re. this concern via email. Addtl Note #2: The Graduate School may have additional feedback on the parent proposal and/or this accompanying Accel named option proposal.

Sara Hagen (skhagen) (03/16/20 1:15 pm): Rollback: For editing

Sara Hagen (skhagen) (04/15/20 3:59 pm): Parent plan will be re-submitted with accompanying updates when Fall 2020 updates are processed.


Elaine Klein (emklein) (05/05/20 2:43 pm): I have consulted with the L&S Departments of Mathematics and of Computer Sciences, both of which agree that the Math and CS courses noted in the proposal above may be used for this program. With that support, the L&S APC voted unanimously to support creation of this program. Thank you for offering the opportunity to comment. (On behalf of the College, Elaine M. Klein, L&S Associate Dean for Academic Planning)