

MECHANICAL ENGINEERING, BS

Banner Code: EC-BS-ME

Academic Advising

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Today, the role of mechanical engineer is ever expanding in order to find innovative solutions for contemporary problems, and to address problems yet to be identified. To meet the growing demands of worldwide energy needs spurred by population growth and dwindling supplies of fossil fuels, for instance, mechanical engineers seek innovations in nuclear energy, bio-fuels, wind, and tidal energies to build an energy portfolio that exploits these seemingly limitless resources. From product design, which spans from biomedical devices to turbo-machinery, to manufacturing, which develops machines and systems needed to process raw materials into these products, an awareness of the benefits of advanced materials for sensing and monitoring the health of these systems and an awareness of the stealth threats to manufacturing brought on by an ever present cyber threat are in the minds of the mechanical engineers. Now more mechanical engineers oversee the operations and management of large systems along with the fiscal and human resources needed to run them.

James Michener once said, "Scientists dream about doing great things. Engineers do them." Mechanical engineers use science to advance technologies and to develop products for the benefit of society, in a discipline which dates back to the earliest of times in civilization. The major in mechanical engineering has three program education objectives, namely:

- Graduates have demonstrated success as a mechanical engineer or their chosen career field;
- Graduates have advanced their educational pursuits through graduate education, professional registration, or similar means;
- Graduates have advanced their careers by engaging in professional society participation and community service outreach.

The bachelor of science in mechanical engineering program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org> (<https://www.abet.org/>), under the commission's General Criteria and Program Criteria for Mechanical and Similarly Named Engineering Programs.

Admissions & Policies

Policies

For policies governing all undergraduate degrees, see AP.5 Undergraduate Policies (<http://catalog.gmu.edu/policies/academic/undergraduate-policies/>).

Change of Major

See Change of Major (<http://catalog.gmu.edu/colleges-schools/engineering-computing/#requirementspolicytext>) for more information.

Grade Requirements and Advising

Degree requirements include 121 credits distributed in three main areas: mechanical engineering, mathematics and basic science, and humanities and social sciences. Students must complete all math, science and College of Engineering and Computing courses presented as part of the required 121 credits for the degree with a grade of C or better.

Students are expected to see their advisor at least once each year to plan their curriculum.

Termination from the Major

No math, science, or College of Engineering and Computing course that is required for the major may be attempted more than three times. Those students who do not successfully complete such a course within three attempts will be terminated from the major. Undeclared students in the College of Engineering and Computing who do not successfully complete a course required for a College of Engineering and Computing major within three attempts will also be terminated.

In addition, students in the College of Engineering and Computing with evidence of continued failure to make adequate progress toward declaring or completing a College of Engineering and Computing major will be terminated from the school. Adequate progress is determined by the major program. For more information, see AP.5.2.4 Termination from the Major (<https://catalog.gmu.edu/policies/academic/undergraduate-policies/#ap-5-2-4>).

Once a student has attempted one of these courses twice unsuccessfully, the third attempt must be no later than the next semester of enrollment, excluding summers. Failure to take the course at that time will result in termination from the major. A third attempt of a College of Engineering and Computing course requires support by the student's major department as well as permission by the department offering the course. This permission is not guaranteed. If the student is unable to take the course when required, the student may request an extension to a future semester; extensions require approval of the student's advisor, their department, and the Associate Dean for Undergraduate Programs. The deadline for extension requests is the add deadline for the semester in which the course is required.

Students who have been terminated from a College of Engineering and Computing major may not register for a College of Engineering and Computing course without permission of the department offering the course. This applies to all undergraduate courses offered by the College of Engineering and Computing except IT 104 Introduction to Computing (Mason Core) (<http://catalog.gmu.edu/mason-core/>) and STAT 250 Introductory Statistics I (Mason Core) (<http://catalog.gmu.edu/mason-core/>).

A student may not declare any major in the College of Engineering and Computing if the student has previously met the termination criteria for that major at any time, regardless of what the student's major was at the time the courses were taken.

Requirements

Degree Requirements

Total credits: 121

Engineering

| Code | Title | Credits |
|----------------|---|---------|
| Courses | | |
| ECE 330 | Circuit Theory | 3 |
| ME 151 | Practicum in Engineering | 2 |
| ME 211 | Statics | 3 |
| ME 212 | Solid Mechanics | 3 |
| ME 221 | Thermodynamics | 3 |
| ME 231 | Dynamics | 3 |
| ME 311 | Mechanical Experimentation I | 1 |
| ME 313 | Material Science | 3 |
| ME 321 | Mechanical Experimentation II | 1 |
| ME 322 | Fluid Mechanics | 3 |
| ME 323 | Heat Transfer | 3 |
| ME 331 | Mechatronics | 3 |
| ME 341 | Design of Mechanical Elements | 3 |
| or ME 342 | Design of Thermal Systems | |
| ME 352 | Entrepreneurship in Engineering | 3 |
| ME 432 | Systems Dynamics and Controls | 4 |
| ME 443 | Mechanical Design I | 3 |
| ME 444 | Mechanical Design II (Mason Core) (http://catalog.gmu.edu/mason-core/) ¹ | 3 |
| ME 453 | Developing the Societal Engineer | 2 |
| Total Credits | | 49 |

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Mason's writing-intensive and synthesis requirements are satisfied by ME 444.

Electives

Students must select **12 upper-level (numbered 300 or above) elective credits** from courses offered within the College of Engineering and Computing. Courses outside the College of Engineering and Computing may be applied toward this elective requirement with prior written approval of the Associate Chair for Undergraduate Programs.

Students may select an optional concentration to fulfill this required elective credit (see below).

Optional Concentrations

The mechanical engineering program requires 12 credits of technical electives. Students may satisfy the technical elective requirement by declaring one of the following concentrations. Completion of the concentration leads to this designation on the student's transcript on graduation.

Select sections of ME 395 Mechanical Engineering Internship, ME 498 Independent Study in Mechanical Engineering, and ME 499 Special Topics in Mechanical Engineering may be applied towards these concentrations with prior written approval of the Associate Chair for Undergraduate Programs.

Concentration in Aerospace Engineering (AENG)

| Code | Title | Credits |
|--|-------|---------|
| Select at least one course from each category, and complete a total of 12 credit hours from the following: | | 12 |

| Astronautics | | |
|---------------------|---------------------------------------|----|
| ME 471 | Introduction to Astronautics | |
| ME 472 | Spacecraft Subsystems | |
| ME 473 | Space Systems Propulsion | |
| ECE 480 | Small Spacecraft Engineering | |
| Aeronautics | | |
| ME 475 | Aeronautics I | |
| ME 476 | Aeronautics II | |
| ME 477 | Aircraft Propulsion | |
| SYST 460 | Introduction to Air Traffic Control | |
| SYST 461 | Air Transportation System Engineering | |
| Total Credits | | 12 |

Concentration in Engineering Mechanics (ENME)

| Code | Title | Credits |
|---------------------------------------|-------|---------|
| Select 12 credits from the following: | | 12 |

| | | |
|---------------|---|----|
| ME 415 | Composite Materials | |
| ME 422 | Computational Fluid Dynamics (CFD) for Mechanical Engineers | |
| ME 423 | Microfluidics | |
| ME 445 | Finite Element Analysis | |
| ME 447 | Computer-Aided Design | |
| ME 466 | Advanced Materials Engineering | |
| ME 467 | Nanosensors | |
| Total Credits | | 12 |

Concentration in Microfabrication (MICF)

| Code | Title | Credits |
|---------------------------------------|-------|---------|
| Select 12 credits from the following: | | 12 |

| | | |
|---------------|---|----|
| ME 423 | Microfluidics | |
| ME 466 | Advanced Materials Engineering | |
| ME 467 | Nanosensors | |
| ECE 430 | Principles of Semiconductor Devices | |
| PHYS 385 | Materials Science with Applications to Renewable Energy | |
| Total Credits | | 12 |

Concentration in Robotics (ROB)

| Code | Title | Credits |
|---------|---|---------|
| ECE 370 | Introduction to Robotics | 3 |
| ECE 427 | Introduction to Machine Learning and Artificial Intelligence in Engineering | 3 |

Select two courses from the following: 6

| | | |
|---------|--|--|
| ME 575 | AI Design and Deployment Risks | |
| ME 576 | AI: Ethics, Policy, and Society | |
| ME 585 | Human Robot Interaction | |
| ME 631 | Advanced Dynamics of Mechanical Systems | |
| ECE 350 | Embedded Systems and Hardware Interfaces | |

| | | |
|---------------|---|----|
| ECE 450 | Mobile Robots | |
| ECE 521 | Linear Systems and Control | |
| ECE 527 | Learning From Data | |
| CS 480 | Introduction to Artificial Intelligence | |
| CYSE 550 | Cyber Security Engineering Fundamentals | |
| Total Credits | | 12 |

Concentration in Specialized Facilities (SPFA)

| Code | Title | Credits |
|--|---|----------|
| ME 421 | HVAC Design | 3 |
| ME 422 | Computational Fluid Dynamics (CFD) for Mechanical Engineers | 3 |
| ME 425 | Renewable Energy Engineering | 3 |
| or PHYS 385 | Materials Science with Applications to Renewable Energy | |
| Select one course from the following: | | 3 |
| ME 409 | Data Center Engineering | |
| ME 410 | Biosafety Laboratories | |
| CYSE 430 | Critical Infrastructure Protection | |
| Total Credits | | 12 |

Computer Science

| Code | Title | Credits |
|--------------------------------|--|---------|
| Select one from the following: | | 4 |
| CS 112 | Introduction to Computer Programming (Mason Core) (http://catalog.gmu.edu/mason-core/) | |
| ENGR 125T | Introduction to Engineering Methods - Transfer (Mason Core) (http://catalog.gmu.edu/mason-core/) | |
| CS 108 & CS 109 | Intro to Computer Programming, Part A (Mason Core) (http://catalog.gmu.edu/mason-core/) and Intro to Computer Programming, Part B | |
| Total Credits | | 4 |

Mathematics and Science

| Code | Title | Credits |
|--------------------------------|---|---------|
| Select one from the following: | | 4 |
| CHEM 211 & CHEM 213 | General Chemistry I (Mason Core) (http://catalog.gmu.edu/mason-core/) and General Chemistry Laboratory I (Mason Core) (http://catalog.gmu.edu/mason-core/) | |
| CHEM 271 & CHEM 272 | General Chemistry for Engineers Lecture (Mason Core) (http://catalog.gmu.edu/mason-core/) and General Chemistry for Engineers Lab (Mason Core) (http://catalog.gmu.edu/mason-core/) | |
| MATH 113 | Analytic Geometry and Calculus I (Mason Core) (http://catalog.gmu.edu/mason-core/) | 4 |

| | | |
|--|--|----|
| or MATH 123 & MATH 124 | Calculus with Algebra/Trigonometry, Part A and Calculus with Algebra/Trigonometry, Part B (Mason Core) (http://catalog.gmu.edu/mason-core/) | |
| MATH 114 | Analytic Geometry and Calculus II | 4 |
| MATH 213 | Analytic Geometry and Calculus III | 3 |
| MATH 214 | Elementary Differential Equations | 3 |
| ME 351 | Analytical Methods in Engineering | 3 |
| PHYS 160 | University Physics I (Mason Core) (http://catalog.gmu.edu/mason-core/) | 3 |
| PHYS 161 | University Physics I Laboratory (Mason Core) (http://catalog.gmu.edu/mason-core/) | 1 |
| PHYS 260 | University Physics II (Mason Core) (http://catalog.gmu.edu/mason-core/) | 3 |
| PHYS 261 | University Physics II Laboratory (Mason Core) (http://catalog.gmu.edu/mason-core/) | 1 |
| Select 3 credits from the list of pre-approved Mathematics and Science Electives (below) | | 3 |
| Total Credits | | 32 |

Mathematics and Science Electives

| Code | Title | Credits |
|---------------------|--|---------|
| BIOL 213 | Cell Structure and Function (Mason Core) (http://catalog.gmu.edu/mason-core/) | 4 |
| BIOL 309 | Oceanography | 3 |
| CHEM 212 & CHEM 214 | General Chemistry II (Mason Core) (http://catalog.gmu.edu/mason-core/) and General Chemistry Laboratory II (Mason Core) (http://catalog.gmu.edu/mason-core/) | 4 |
| CLIM 411 | Atmospheric Dynamics | 3 |
| CLIM 412 | Physical Oceanography | 3 |
| CLIM 429 | Atmospheric Thermodynamics | 3 |
| EVPP 210 | Environmental Biology: Molecules and Cells | 4 |
| GEOL 412 | Physical Oceanography | 3 |
| PHYS 262 & PHYS 263 | University Physics III (Mason Core) (http://catalog.gmu.edu/mason-core/) and University Physics III Laboratory (Mason Core) (http://catalog.gmu.edu/mason-core/) | 4 |
| PHYS 308 | Modern Physics | 3 |
| PHYS 331 | Physics of Renewable Energy | 3 |
| MATH 203 | Linear Algebra | 3 |
| MATH 301 | Number Theory | 3 |
| MATH 125 | Discrete Mathematics I (Mason Core) (http://catalog.gmu.edu/mason-core/) | 3 |
| MATH 302 | Foundations of Geometry | 3 |
| MATH 312 | Geometry | 3 |
| MATH 313 | Introduction to Applied Analysis | 3 |
| MATH 314 | Advanced Differential Equations | 3 |
| MATH 351 | Probability | 3 |
| MATH 411 | Functions of a Complex Variable | 3 |

| | | |
|----------|---|---|
| STAT 344 | Probability and Statistics for Engineers and Scientists I | 3 |
| STAT 346 | Probability for Engineers | 3 |

Communication and Economics

| Code | Title | Credits |
|-------------|--|---------|
| COMM 100 | Public Speaking (Mason Core) (http://catalog.gmu.edu/mason-core/) ¹ | 3 |
| or COMM 101 | Fundamentals of Communication (Mason Core) (http://catalog.gmu.edu/mason-core/) | |
| ECON 103 | Contemporary Microeconomic Principles (Mason Core) (http://catalog.gmu.edu/mason-core/) | 3 |

Total Credits 6

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Or completion of the Honors College Curriculum (<https://honorscollege.gmu.edu/>).

Additional Mason Core

| Code | Title | Credits |
|--|-------|---------|
| Arts (http://catalog.gmu.edu/mason-core/#arts) | | 3 |
| Global Contexts (http://catalog.gmu.edu/mason-core/#globalcontexts) | | 3 |
| Literature (http://catalog.gmu.edu/mason-core/#literature) | | 3 |
| Global History (http://catalog.gmu.edu/mason-core/#global-history) | | 3 |
| Written Communication (http://catalog.gmu.edu/mason-core/#written) ¹ | | 6 |

Total Credits 18

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Both lower and upper level requirement.

4-Year Plan

Bachelors of Science in Mechanical Engineering Sample Plan of Study

Detailed four year plans and degree planning checklists can be found at <https://advising.gmu.edu/current-student/majors-at-mason/>.

Accelerated Master's

Mechanical Engineering, BS/Applied and Engineering Physics, Accelerated MS Overview

This program allows academically strong undergraduates with a demonstrable commitment to research to obtain the Mechanical Engineering, BS and Applied and Engineering Physics, MS (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/applied-engineering-physics-ms/>) degrees by successfully completing 139 credits. Upon completion, students are well-prepared for entering into the professional workforce, or a PhD program in physics or a related engineering discipline.

Admitted students take selected graduate courses after having completed 75 undergraduate credits and are able to use 3-12 graduate credits in partial satisfaction of requirements for the undergraduate degree. Upon completion and conferral of the bachelor's degree and with satisfactory performance (grade of 'B' or better) in each of the graduate courses, students are given advanced standing in the master's program and complete an additional 18-27 credits to receive the master's degree.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7>). For policies governing all graduate degrees, see AP.6 Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/>).

Application Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in the Graduate Admission Policies (<http://catalog.gmu.edu/admissions/graduate-policies/>) section of this catalog.

Successful applicants majoring in Mechanical Engineering will have completed at least 60 credits toward their undergraduate degree with an overall GPA of at least 3.00, and the following courses with a GPA of 3.00 or better:

| Code | Title | Credits |
|--------|---|---------|
| CS 112 | Introduction to Computer Programming (Mason Core) (http://catalog.gmu.edu/mason-core/) | 4 |
| ME 212 | Solid Mechanics | 3 |
| ME 231 | Dynamics | 3 |
| ME 313 | Material Science | 3 |
| ME 322 | Fluid Mechanics | 3 |
| ME 323 | Heat Transfer | 3 |
| ME 351 | Analytical Methods in Engineering | 3 |

One or more recommendation letters from one or more research supervisors are also required. Interested applicants majoring in Mechanical Engineering, BS should submit a letter to the undergraduate Mechanical Engineering coordinator and the Physics Graduate Coordinator, respectively, requesting admission along with the aforementioned recommendation letter(s). Contact the Mechanical Engineering undergraduate and the Physics graduate coordinator for further details.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific pre-requisites

Accelerated Option Requirements

At the beginning of the student's final undergraduate semester, students must submit a bachelor's/accelerated master's transition form (<http://registrar.gmu.edu/forms/>) to the College of Science's Office of Academic and Student Affairs (<https://cos.gmu.edu/about/contact-us/>). Students must begin their master's program in the semester immediately following conferral of the bachelor's degree.

Students must maintain an overall GPA of 3.00 or higher in graduate coursework.

Reserve Graduate Credit

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree.

Graduate Course Suggestions

The following list of suggested courses is provided for general reference. To ensure an efficient route to graduation and career-readiness, students are strongly encouraged to meet with an advisor before registering for graduate-level courses.

| Code | Title | Credits |
|----------|----------------------------|---------|
| PHYS 510 | Computational Physics I | 3 |
| PHYS 613 | Computational Physics II | 3 |
| PHYS 620 | Continuum Mechanics | 3 |
| PHYS 690 | Engineering Thermodynamics | 3 |

Mechanical Engineering, BS/Applied Information Technology, Accelerated MS Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program and obtain a Mechanical Engineering, BS and an Applied Information Technology, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/applied-information-technology-ms/>) in an accelerated time-frame after satisfactory completion of a minimum of 139 credits.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>) for policies related to this program.

Students in an accelerated degree program must fulfill all university requirements for the master's degree. For policies governing all graduate degrees, see AP.6 Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/>).

BAM Pathway Admission Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in Graduate Admissions Policies and Bachelor's/Accelerated Master's Degree policies.

Mechanical Engineering, BS Students will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits, and additional unit-specific criteria.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific pre-requisites.

The criteria for admission are identical to criteria for admission to the Applied Information Technology, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/applied-information-technology-ms/>) program.

Accelerated Pathway Requirements

To maintain the integrity and quality of both the undergraduate and graduate degree programs, undergraduate students interested in taking graduate courses must choose from the following:

Advanced Standing Courses

Students must complete all credits that satisfy requirements for both the BS and MS programs. Up to four courses (12 credits) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree.

| Code | Title | Credits |
|---------|---|---------|
| AIT 524 | Database Management Systems | 3 |
| AIT 542 | Fundamentals of Computing Platforms | 3 |
| AIT 664 | Information: Representation, Processing and Visualization | 3 |
| AIT 512 | Algorithms and Data Structures Essentials ¹ | 3 |
| AIT 580 | Analytics: Big Data to Information ² | 3 |

1

This course should be selected for all concentrations except for the IT Management concentration

2

This course should be selected for the IT Management concentration

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Students are strongly encouraged to meet with a graduate advisor to select reserve graduate credits. Reserve graduate credits do not apply to the undergraduate degree.

Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form. At the completion of MS requirements, a master's degree is conferred.

Mechanical Engineering, BS / Bioengineering, Accelerated MS Overview

Highly-qualified students in the Mechanical Engineering, BS have the option of obtaining an accelerated Bioengineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/bioengineering/bioengineering-ms/>).

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>). For policies governing all graduate degrees, see AP.6 Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>).

Admission Requirements

Mason undergraduate students majoring in Mechanical Engineering, BS may apply to this option if they have earned 60 undergraduate credits with an overall GPA of at least 3.20, completed all MATH and PHYS requirements, and passed BENG 320 Bioengineering Signals and Systems and BIOL 213 Cell Structure and Function (Mason Core) (<http://>

catalog.gmu.edu/mason-core/) with the grade of C or better. It is also recommended that students take BENG 214 Physiology for Engineers and are proficient in MATLAB. Criteria for admission are identical to criteria for admission to the Bioengineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/bioengineering/bioengineering-ms/>) program.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific pre-requisites.

Accelerated Options Requirement

Students must complete all credits that satisfy requirements for both the BS and MS programs. Students take up to 9 credits of approved MS level BENG courses as part of their undergraduate degree that will also be applied to the graduate degree. The courses selected for this purpose must be approved by the academic advisor of both the BS and MS programs and by the Bioengineering department chair.

Specifically, students are encouraged to take up to three of the following courses to apply towards both their undergraduate and graduate degree.

| Code | Title | Credits |
|-------------------------|--|---------|
| BENG 520 | Biomedical Data Analytics | 3 |
| BENG 521 or BENG 541 | Cell and Tissue Engineering Biomaterials | 3 |
| BENG 526 | Neural Engineering | 3 |
| BENG 537 or BENG 538 | Medical Image Processing Medical Imaging | 3 |
| BENG 501 | Bioengineering Research Methods | 3 |
| BENG 514 | Pathophysiology and the Role of New Technologies in Human Diseases | 3 |
| BENG 575 | Intellectual Property, Regulatory Concepts and Product Development | 3 |

Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form. At the completion of MS requirements, a master's degree is conferred.

Mechanical Engineering, BS/Civil and Infrastructure Engineering, Accelerated MS

Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program and obtain a Mechanical Engineering, BS and a Civil and Infrastructure Engineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/civil-environmental-infrastructure/civil-infrastructure-engineering-ms/>). in an accelerated time-frame after satisfactory completion of a minimum of 139 credits.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (<https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7>) for policies related to this program.

Students in an accelerated degree program must fulfill all university requirements for the master's degree. For policies governing all graduate degrees, see AP.6 Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/>).

Admission Requirements

Students in the Mechanical Engineering, BS program may apply to this option if they have earned 60 undergraduate credits with an overall GPA of at least 3.30. All other criteria for admission are identical to criteria for admission into the Civil and Infrastructure Engineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/civil-environmental-infrastructure/civil-infrastructure-engineering-ms/>) program.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific pre-requisites.

Accelerated Option Requirements

Students must complete all credits that satisfy requirements for both the BS and MS programs. Students register for up to 12 credits of overlapping graduate level courses in place of undergraduate technical elective courses.

Students are encouraged to take up to four of the following courses, based on their chosen concentration area in the master's program:

Concentration in Construction Engineering and Management (CEM)

| Code | Title | Credits |
|----------|---|---------|
| CEIE 571 | Construction Administration | 3 |
| CEIE 572 | Building Information Modeling | 3 |
| CEIE 573 | Legal Aspects of the Construction Process | 3 |
| CEIE 575 | Design for Constructability | 3 |
| CEIE 576 | Construction Cost Estimating | 3 |

Concentration in Environmental and Water Resources Engineering (EWRE)

| Code | Title | Credits |
|----------|---|---------|
| CEIE 540 | Water Supply and Distribution | 3 |
| CEIE 542 | Open Channel Flow | 3 |
| CEIE 550 | Environmental Engineering Systems | 3 |
| CEIE 553 | Water and Wastewater Treatment Processes | 3 |
| CEIE 557 | Remote Monitoring Techniques for Civil Engineering Applications | 3 |

Concentration in Geotechnical Engineering (GEOE)

| Code | Title | Credits |
|----------|--|---------|
| CEIE 501 | Sustainable Development | 3 |
| CEIE 524 | Introduction to Bridge Engineering | 3 |
| CEIE 531 | Earth Retaining Structures and Slope Stability | 3 |
| CEIE 532 | Foundation Design | 3 |
| CEIE 535 | Engineering Geology | 3 |

Concentration in Structural Engineering (STRE)

| Code | Title | Credits |
|----------|--|---------|
| CEIE 512 | Structural Steel Design | 3 |
| CEIE 513 | Reinforced Concrete Design | 3 |
| CEIE 525 | Structural Evaluation and Rehabilitation | 3 |
| CEIE 532 | Foundation Design | 3 |
| CEIE 575 | Design for Constructability | 3 |

Concentration in Transportation Engineering (TRNE)

| Code | Title | Credits |
|----------|-------------------------------|---------|
| CEIE 560 | Public Transportation Systems | 3 |
| CEIE 561 | Traffic Engineering | 3 |
| CEIE 562 | Urban Transportation Planning | 3 |
| STAT 544 | Applied Probability | 3 |

Students also have the option of taking the following one or two additional graduate-level courses for reserve that will only count for the graduate degree program:

| Code | Title | Credits |
|----------|---|---------|
| CEIE 601 | Infrastructure Modeling | 3 |
| CEIE 605 | Risk and Uncertainty in Civil Engineering | 3 |

Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form. At the completion of MS requirements, a master's degree is conferred.

Advising & Plan of Study

Each student is assigned a faculty advisor upon acceptance. Students must meet with their advisors during their first semester and design an approved plan of study. Students are encouraged to seek out their advisor when questions arise and when their plan of study needs to be revised.

Students must have a working background in their selected concentration area. A student lacking these foundations may be required to take one or more foundation courses.

Mechanical Engineering, BS/ Computational Science, Accelerated MS Overview

This option enables enthusiastic, highly qualified, undergraduates to obtain the Mechanical Engineering, BS (<https://mechanical.gmu.edu/>) and the Computational Science, MS (<http://catalog.gmu.edu/colleges-schools/science/computational-data-sciences/computational-sciences-ms/>) within the accelerated time frame of five years. The program requires 139 credits total, allowing students to undertake graduate coursework during their final year in the bachelor's degree. Upon completion of this 139 credit BS/MS combined program, students are exceptionally well prepared for undertaking doctoral studies or entering the professional workforce.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7>). For policies governing all graduate degrees, see AP.6

Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/>).

Application Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in the Graduate Admission Policies (<http://catalog.gmu.edu/admissions/graduate-policies/>) section of this catalog¹. Application information for this Accelerated Master's program can be found on the Department of Computational and Data Sciences (<http://cos.gmu.edu/cds/academic-programs/>) website. Applicants must have an overall undergraduate GPA of at least 3.00 and have completed at least 60 credits. Additionally, applicants will have completed the following courses with a GPA of 3.00 or better:

| Code | Title | Credits |
|---------------|---|---------|
| CS 112 | Introduction to Computer Programming (Mason Core) (http://catalog.gmu.edu/mason-core/) | 4 |
| ME 212 | Solid Mechanics | 3 |
| ME 231 | Dynamics | 3 |
| ME 313 | Material Science | 3 |
| ME 322 | Fluid Mechanics | 3 |
| ME 323 | Heat Transfer | 3 |
| ME 351 | Analytical Methods in Engineering | 3 |
| Total Credits | | 22 |

Students must maintain an overall GPA of 3.00 or higher in graduate coursework and should consult with their faculty advisor to coordinate their academic goals within the modeling and simulation or data science emphases of the Computational Science, MS (<http://catalog.gmu.edu/colleges-schools/science/computational-data-sciences/computational-sciences-ms/>).

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific pre-requisites

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GRE-general scores are waived for graduates of BS degrees from any program in the College of Science or the Volgenau School of Engineering at George Mason University.

Accelerated Option Requirements

Students must complete all credits that satisfy requirements for both the BS and MS programs, with up to twelve credits overlap chosen from the following courses:

| Code | Title | Credits |
|--|---|---------|
| CSI 500 | Computational Science Tools | 3 |
| CSI 501 | Computational Science Programming | 3 |
| CSI 600 | Quantitative Foundations for Computational Sciences | 3 |
| Select one course from the following options: | | 3 |
| Any CDS, CSI, or CSS-prefixed courses numbered 500-689, or | | |
| STAT 544 | Applied Probability | |
| STAT 554 | Applied Statistics I | |
| Total Credits | | 12 |

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree.

For more detailed information on coursework and timeline requirements, see AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7>).

Mechanical Engineering, BS/Data Analytics Engineering, Accelerated MS

Overview

Highly-qualified students in the Mechanical Engineering, BS program have the option of applying to the accelerated Data Analytics Engineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/data-analytics-engineering-ms/>) program.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7>). For policies governing all graduate degrees, see AP.6 Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/>).

Admission Requirements

Students in the Mechanical Engineering, BS program may apply to the accelerated Data Analytics Engineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/data-analytics-engineering-ms/>) program if they have earned 60 undergraduate credits with an overall GPA of at least 3.30.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific pre-requisites.

Accelerated Option Requirements

Students must complete all credits that satisfy requirements for the BS and MS programs, with up to twelve credits overlap chosen from the following courses:

| Code | Title | Credits |
|----------|--|---------|
| AIT 580 | Analytics: Big Data to Information | 3 |
| CS 504 | Principles of Data Management and Mining | 3 |
| OR 531 | Introduction to Analytics and Modeling | 3 |
| STAT 515 | Applied Statistics and Visualization for Analytics | 3 |

All graduate course prerequisites must be completed prior to enrollment. Each 500-level course must be completed with a grade of B or better to apply toward the MS program. The graduate courses selected for overlap must be approved by the academic advisors of both the BS and MS programs. The graduate courses may be counted as Electives toward the Mechanical Engineering, BS program requirements, with approval of the Mechanical Engineering Department.

Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must

complete a Bachelor's/Accelerated Master's Transition form. At the completion of MS requirements, a master's degree is conferred.

Mechanical Engineering, BS/Electrical Engineering, Accelerated MS

Overview

The university offers highly-qualified students in the Mechanical Engineering, BS the option of obtaining an accelerated Electrical Engineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/electrical-computer/electrical-engineering-ms/>).

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7>). For policies governing all graduate degrees, see AP.6 Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>).

Admission Requirements

Students in the Mechanical Engineering, BS program may apply for this option if they have earned 60 undergraduate credits, with an overall GPA of at least 3.0, and passed MATH 203 Linear Algebra and STAT 346 Probability for Engineers, or their equivalents, with the grade C or better. Criteria for admission are identical to criteria for admission to the Electrical Engineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/electrical-computer/electrical-engineering-ms/>) program.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific pre-requisites.

Accelerated Option Requirements

Students must complete all credits that satisfy the requirements for the BS and MS programs, with up to 9 credits overlapping.

Students take up to 9 credits of 500-level ECE (<http://catalog.gmu.edu/courses/ece/>) or SYST (<http://catalog.gmu.edu/courses/syst/>) courses as part of their technical electives or substitutes for required courses in the Mechanical Engineering, BS program.

Specifically, students are encouraged to take up to three of the following courses:

| Code | Title | Credits |
|----------|---|---------|
| ECE 521 | Linear Systems and Control | 3 |
| ECE 527 | Learning From Data | 3 |
| ECE 528 | Introduction to Random Processes in Electrical and Computer Engineering | 3 |
| ECE 539 | Neural Engineering | 3 |
| ECE 580 | Small Spacecraft Engineering | 3 |
| SYST 521 | Network Analysis | 3 |

Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form. At the completion of MS requirements, a master's degree is conferred.

Mechanical Engineering, BS/Operations Research, Accelerated MS

Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program and obtain a Mechanical Engineering, BS and an Operations Research, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/operations-research-ms/>) in an accelerated time-frame after satisfactory completion of a minimum of 139 credits.

Admitted students are able to use up to 12 graduate credits in partial satisfaction of requirements for the undergraduate degree. Upon completion and conferral of the bachelor's degree and with satisfactory performance (grade of 'B' or better) in each of the graduate courses, students are given advanced standing in the master's program.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (<https://catalog.gmu.edu/policies/academic/graduate-policies/#text>) for policies related to this program.

Students in an accelerated degree program must fulfill all university requirements for the master's degree. For policies governing all graduate degrees, see AP.6 Graduate Policies (<https://catalog.gmu.edu/policies/academic/graduate-policies/>).

BAM Pathway Admission Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in Graduate Admissions Policies and Bachelor's/Accelerated Master's Degree policies.

Mechanical Engineering, BS students will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits with an overall GPA of at least 3.3, and completion of all MATH and PHYS requirements. Students must additionally complete MATH 203 Linear Algebra prior to applying for the graduate program.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific pre-requisites.

Accelerated Master's Admission Requirements

The criteria for admission are identical to criteria for admission to the Operations Research, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/operations-research-ms/>) program. Students already admitted in the BAM Pathway will be admitted to the Operations Research, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/operations-research-ms/>) program, if they have met the following criteria, as verified on the Bachelor's/Accelerated Master's Transition form:

- An overall GPA of at least 3.3
- Successfully meeting Mason's requirements for undergraduate degree conferral (graduation) and completing the application for graduation.

Accelerated Pathway Requirements

To maintain the integrity and quality of both the undergraduate and graduate degree programs, undergraduate students interested in taking graduate courses must choose from the following:

Advanced Standing course: Students must complete all credits that satisfy requirements for both the BS and MS programs. Up to four courses (12 credits) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree. The courses selected for this purpose must be approved by the academic advisors of both the BS and MS programs and by the SEOR department chair. For the BS programs that allow undergraduate electives from the department of system engineering and operations research, the students may choose the graduate version of such elective courses to replace the corresponding undergraduate courses.

- Students selecting up to two courses (6 credits) of approved master's level courses may select from the combined Mechanical Engineering course list and Systems Engineering and Operations Research course list given below.
- Students selecting up to three or four courses (9 or 12 credits) of approved master's level courses may select at most two courses from the Mechanical Engineering course list and select the remaining courses from the Systems Engineering and Operations Research course list given below. Students are highly recommended to select courses marked as core courses because it applies to the master's degree regardless of the graduate-level concentration chosen in the Operations Research, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/operations-research-ms/>). The undergraduate version of these courses, if any, may *not* be applied toward the Operations Research, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/operations-research-ms/>). Credit may not be received for both the undergraduate and graduate version of these courses.
- Some of the courses in the Systems Engineering and Operations Research course list applies only to certain concentrations in the Operations Research, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/operations-research-ms/>) program.
- Students must pay attention to the prerequisites required for a course, and the master's degree concentration that the course may satisfy.

Select at most two from the following Mechanical Engineering courses:

| Code | Title | Credits |
|--------|---------------------|---------|
| ME 521 | Energy Transfer | |
| ME 531 | Energy Transmission | |
| ME 541 | Power Generation | |
| ME 542 | Energy Utilization | |

Select the remaining from the following Systems Engineering and Operations Research courses:

| Code | Title | Credits |
|----------|--|---------|
| SYST 521 | Network Analysis | |
| OR 538 | Analytics for Financial Engineering and Econometrics | |
| OR 541 | Operations Research: Deterministic Optimization (Core) | |

| | |
|--------|--|
| OR 542 | Operations Research: Stochastic Models (Core) |
| OR 568 | Applied Predictive Analytics (Core) |
| OR 588 | Financial Systems Engineering I: Introduction to Options, Futures, and Derivatives |

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree.

For more detailed information on coursework and timeline requirements, see AP.6.7 Bachelor's/Accelerated Master's Degrees (<https://catalog.gmu.edu/policies/academic/graduate-policies/#text>).

Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form. At the completion of MS requirements, a master's degree is conferred.

Mechanical Engineering, BS/Systems Engineering, Accelerated MS

Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program and obtain a Mechanical Engineering, BS and a Systems Engineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/systems-engineering-ms/>) in an accelerated time-frame after satisfactory completion of a minimum of 139 credits.

Admitted students are able to use up to 12 graduate credits in partial satisfaction of requirements for the undergraduate degree. Upon completion and conferral of the bachelor's degree and with satisfactory performance (grade of 'B' or better) in each of the graduate courses, students are given advanced standing in the master's program.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>) for policies related to this program.

Students in an accelerated degree program must fulfill all university requirements for the master's degree. For policies governing all graduate degrees, see AP.6 Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/>).

BAM Pathway Admission Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in Graduate Admissions Policies and Bachelor's/Accelerated Master's Degree policies.

Mechanical Engineering, BS students will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits with an overall GPA of at least 3.3, and completion of all MATH and PHYS requirements.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific pre-requisites.

Accelerated Master's Admission Requirements

The criteria for admission are identical to criteria for admission to the Systems Engineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/systems-engineering-ms/>) program. Students already admitted in the BAM Pathway will be admitted to the Systems Engineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/systems-engineering-ms/>) program, if they have met the following criteria, as verified on the Bachelor's/Accelerated Master's Transition form:

- An overall GPA of at least 3.3
- Successfully meeting Mason's requirements for undergraduate degree conferral (graduation) and completing the application for graduation.

Accelerated Pathway Requirements

To maintain the integrity and quality of both the undergraduate and graduate degree programs, undergraduate students interested in taking graduate courses must choose from the following:

Advanced Standing course: Students must complete all credits that satisfy requirements for both the BS and MS programs. Up to four courses (12 credits) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree. The courses selected for this purpose must be approved by the academic advisors of both the BS and MS programs and by the SEOR department chair. For the BS programs that allow undergraduate electives from the department of system engineering and operations research, the students may choose the graduate version of such elective courses to replace the corresponding undergraduate courses.

- Students selecting up to two courses (6 credits) of approved master's level courses may select from the combined Mechanical Engineering course list and Systems Engineering and Operations Research course list given below.
- Students selecting up to three or four courses (9 or 12 credits) of approved master's level courses may select at most two courses from the Mechanical Engineering course list and select the remaining courses from the Systems Engineering and Operations Research course list given below. Students are highly recommended to select courses marked as core courses because it applies to the master's degree regardless of the graduate-level concentration chosen in the Systems Engineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/systems-engineering-ms/>) program. The undergraduate version of these courses, if any, may *not* be applied toward the Systems Engineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/systems-engineering-ms/>). Credit may not be received for both the undergraduate and graduate version of these courses.
- Except for the courses marked as core, any course chosen from either course list can be used to satisfy SYST 505 Systems Engineering Principles core requirement in the Systems Engineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/systems-engineering-ms/>) program.

- Some of the courses in the Systems Engineering and Operations Research course list applies only to certain concentrations in the Systems Engineering, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/systems-engineering-ms/>) program.
- Students must pay attention to the prerequisites required for a course, and the master's degree concentration that the course may satisfy.

Select at most two from the following Mechanical Engineering courses:

| Code | Title | Credits |
|--------|---------------------|---------|
| ME 521 | Energy Transfer | |
| ME 531 | Energy Transmission | |
| ME 541 | Power Generation | |
| ME 542 | Energy Utilization | |

Select the remaining from the following Systems Engineering and Operations Research courses:

| Code | Title | Credits |
|----------|--|---------|
| SYST 510 | Systems Definition and Cost Modeling (Core) | |
| SYST 514 | Systems Thinking | |
| SYST 520 | System Engineering Design (Core) | |
| SYST 530 | Systems Engineering Management I (Core) | |
| SYST 542 | Decision Support Systems Engineering | |
| SYST 573 | Decision and Risk Analysis | |
| SYST 538 | Analytics for Financial Engineering and Econometrics | |
| SYST 560 | Introduction to Air Traffic Control | |
| SYST 563 | Evidence-Based Systems Engineering | |
| SYST 568 | Applied Predictive Analytics | |
| SYST 584 | Heterogeneous Data Fusion | |
| SYST 588 | Financial Systems Engineering I: Introduction to Options, Futures, and Derivatives | |

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree.

For more detailed information on coursework and timeline requirements, see AP6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#text>).

Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form. At the completion of MS requirements, a master's degree is conferred.