Minors in the Batten College of Engineering and Technology

The upper-division General Education requirement can be met by selecting a minor.

Minor in Aerospace Engineering

The Department of Mechanical and Aerospace Engineering offers a minor program in aerospace engineering comprising four courses chosen from the following list:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAE 403</td>
<td>Flight Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>MAE 406</td>
<td>Flight Vehicle Aerodynamics</td>
<td>3</td>
</tr>
<tr>
<td>MAE 417</td>
<td>Propulsion Systems</td>
<td>3</td>
</tr>
<tr>
<td>MAE 420</td>
<td>Aerospace Structures</td>
<td>3</td>
</tr>
<tr>
<td>MAE 460</td>
<td>Introduction to Space Systems Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours Required (choose 4 courses): 12

It may be possible to substitute other appropriate senior-level mechanical and aerospace engineering courses with prior approval of the Mechanical and Aerospace Engineering Department, such as MAE 440 in lieu of MAE 420. The minor in aerospace engineering is open to all students. All prerequisites and corequisites must be satisfied for all courses taken.

For completion of a minor, a student must have a minimum overall cumulative grade point average of 2.00 in all courses required for the minor exclusive of lower-level courses, prerequisites and corequisites and complete at least six hours of upper-level courses in the minor requirement through courses offered by Old Dominion University.

Interdisciplinary Minor – Biomedical Engineering

Christian Zenlin, Department of Electrical and Computer Engineering, Coordinator

This interdisciplinary minor is for students who would like to learn about processes encountered in biomedical engineering innovation and enhance their ability to integrate knowledge from different disciplines with principles used in biomedical engineering. The minor offers an opportunity for students to be recognized for study in this growing multidisciplinary field and to enhance competitiveness for job opportunities upon graduation.

Course requirements are as follows:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BME 401</td>
<td>Biomedical Engineering I: Principles and Biomedical Engineering II: Applications</td>
<td>6</td>
</tr>
</tbody>
</table>

Select two elective courses from the following: 6

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 446</td>
<td>Comparative Biomechanics</td>
</tr>
<tr>
<td>BIOL 460</td>
<td>Frontiers in Nanoscience and Nanotechnology</td>
</tr>
<tr>
<td>BIOL 490</td>
<td>Advanced Human Physiology</td>
</tr>
<tr>
<td>BIOL 496</td>
<td>Topics</td>
</tr>
<tr>
<td>CHEM 443</td>
<td>Intermediate Biochemistry</td>
</tr>
<tr>
<td>EXSC 322</td>
<td>Anatomical Kinesiology</td>
</tr>
<tr>
<td>EXSC 417W</td>
<td>Biomechanics</td>
</tr>
<tr>
<td>ECE 454</td>
<td>Introduction to Bioelectronics</td>
</tr>
<tr>
<td>ECE 462</td>
<td>Introduction to Medical Image Analysis (MIA)</td>
</tr>
<tr>
<td>HLSC 405</td>
<td>Interprofessional Study Abroad on Global Health</td>
</tr>
<tr>
<td>MAE 303</td>
<td>Mechanics of Fluids</td>
</tr>
<tr>
<td>MAE 440</td>
<td>Introduction to Finite Element Analysis</td>
</tr>
<tr>
<td>MATH 316</td>
<td>Introductory Linear Algebra</td>
</tr>
<tr>
<td>MEDT 324</td>
<td>Clinical Instrumentation and Electronics</td>
</tr>
<tr>
<td>MGMT 325</td>
<td>Contemporary Organizations and Management</td>
</tr>
<tr>
<td>MSIM 451</td>
<td>Analysis for Modeling and Simulation</td>
</tr>
<tr>
<td>NMED 331</td>
<td>Fundamental Concepts in Nuclear Medicine Technology</td>
</tr>
<tr>
<td>NURS 458</td>
<td>Studies in Professional Nursing</td>
</tr>
</tbody>
</table>

Students have the option to substitute one course from those that satisfy their major requirements for one of the minor electives with approval of the minor coordinator.

Total Hours 12

The interdisciplinary minor in biomedical engineering requires 12 credit hours of 300/400-level courses selected from at least two different disciplines with a maximum of six credits from any one discipline. For completion of the interdisciplinary minor, students must have a minimum overall cumulative grade point average of 2.00 in all courses required for the minor exclusive of lower-level courses and prerequisite courses. At least six hours of upper-level courses must be taken through courses offered by Old Dominion University. Three credit hours may be in the major, if a major course is listed as an option for the interdisciplinary minor. As such, it will be credited toward both the major and the interdisciplinary minor.

Minor in Civil Engineering

An undergraduate minor in civil engineering may be obtained by students from outside of the major by successful completion of 12 or more semester credit hours in approved civil engineering course work at the 300 or 400 level. In addition, a student seeking a minor in civil engineering must satisfy all pre- or corequisite requirements for the courses selected.

The course requirements are:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 323</td>
<td>Soil Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>or CEE 340</td>
<td>Hydraulics and Water Resources</td>
<td>3</td>
</tr>
<tr>
<td>CEE 310</td>
<td>Structures I</td>
<td>3</td>
</tr>
<tr>
<td>CEE 470</td>
<td>Transportation Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>or CEE 4xx **</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEE 4xx **</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours 12

** CEE 4xx can be any senior-level elective in coastal, geotechnical, structural or water resources engineering. The precise course of study must be approved by the chief departmental advisor.

For completion of a minor, a student must have a minimum overall cumulative grade point average of 2.00 in all courses required for the minor exclusive of lower-level courses, prerequisites and corequisites and complete a minimum of six hours of upper-level courses in the minor requirement through courses offered by Old Dominion University. Completion of a minor in civil engineering with a grade point average of 3.00 or greater partially satisfies the leveling requirements for graduate degrees in civil engineering.

Minor in Civil Engineering Technology – Construction

The minor in civil engineering technology – construction is open to all students (except civil engineering technology majors). The program consists of 12 credits and the specified courses are as follows:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CET 355</td>
<td>Sustainable Building Practices</td>
<td>3</td>
</tr>
<tr>
<td>CET 445</td>
<td>Construction Planning and Scheduling</td>
<td>3</td>
</tr>
<tr>
<td>CET 460</td>
<td>Construction Cost Estimating</td>
<td>3</td>
</tr>
<tr>
<td>CET 465</td>
<td>Construction Project Management</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours 12
The courses are offered both on campus and through distance learning.

For completion of a minor, a student must have a minimum overall cumulative grade point average of 2.00 in all courses required for the minor exclusive of lower-level courses and prerequisite courses and complete at least six hours in upper-level courses in the minor requirement through courses offered by Old Dominion University.

**Minor in Computer Engineering**

An undergraduate minor in computer engineering may be obtained by successful completion of 12 or more semester credit hours of approved electrical or computer engineering or computer science course work at the 300 or 400 level. In addition, a student seeking a minor in computer engineering must satisfy all pre- or corequisite requirements for the courses selected. The chief departmental advisor must approve the precise course of study.

The basic course requirements are as follows:

- CS 333  Programming and Problem Solving in C++  4
- CS 250 and CS 252 may be substituted for CS 333.*
- CS 361  Advanced Data Structures and Algorithms  3
- Select two of the following:  6
  - ECE 340  Digital Circuits (not available to ECE students)
  - ECE 341  Digital System Design
  - ECE 346  Microcontrollers
  - ECE 355  Introduction to Networks and Data Communications
  - ECE 381  Introduction to Discrete-time Signal Processing
  - ECE 406  Introduction to Visualization
  - ECE 441  Advanced Digital Design and Field Programmable Gate Arrays
  - ECE 455  Network Engineering and Design
  - ECE 483  Embedded Systems

**Total Hours**  13

* CS 150 is a prerequisite for CS 250 and CS 252 and is not included in the calculation of the GPA for the minor.

For completion of a minor, a student must have a minimum overall cumulative grade point average of 2.00 for the courses required for the minor exclusive of lower-level courses, prerequisites and corequisites and complete a minimum of six hours of upper division courses in the minor through courses offered by Old Dominion University. Completion of a minor in computer engineering with a GPA of 3.00 or greater partially satisfies the leveling requirements for graduate degrees in computer engineering.

**Interdisciplinary Minor - Cybersecurity**

Tamer Nadeem, Department of Computer Science, Coordinator (tnadeem@odu.edu)

This interdisciplinary minor in cybersecurity is focused on the technological, structural, social, and legal frameworks used to secure computer networks and software. The study of cybersecurity combines multiple fields including computer science, engineering, information technology, criminal justice, and philosophy, to name a few. In an effort to promote the security of computer networks, software, and cyber information, an interdisciplinary understanding about technological, legal, philosophical, and structural aspects of cyber crime is needed. This minor will provide students from different majors the knowledge they need to prevent or respond to cyber incidents they are likely to encounter in their careers.

Course options are as follows:

- CRJS 405  Cybercrime and Cybersecurity  3
- CS 462  Cybersecurity Fundamentals  3
- or ECE/ENMA/MSIM 470  Foundations of Cyber Security  3
- CS 463  Cryptography for Cybersecurity  3
- CS 464  Networked Systems Security  3
- or ECE/ENMA/MSIM 411  Networked System Security  3
- CS 465  Information Assurance  3
- IT 416  Network Server Configuration and Administration  3
- IT 417  Management of Information Security  3
- IT 461  Implementing Internet Applications  3
- PHIL 355E  Computer Ethics  3
- ECE 416  Cyber Defense Fundamentals  3
- or ENMA/MSIM 416  Cyber Defense Fundamentals  3
- ECE 417  Secure and Trusted Operating Systems  3
- or ENMA/MSIM 417  Secure and Trusted Operating Systems  3
- ECE 419  Cyber Physical System Security  3
- or ENMA/MSIM 419  Cyber Physical Systems Security  3

The interdisciplinary minor in cybersecurity requires 12 credit hours of 300/400-level courses selected from at least two different disciplines with a maximum of six credits from any one discipline. For completion of the interdisciplinary minor, students must have a minimum overall cumulative grade point average of 2.00 in all courses required for the minor exclusive of lower-level courses and prerequisite courses. At least six hours of upper-level courses must be taken through courses offered by Old Dominion University. Three credit hours may be in the major, if a major course is listed as an option for the interdisciplinary minor. As such, it will be credited toward both the major and the interdisciplinary minor.

**Minor in Electrical Engineering**

An undergraduate minor in electrical engineering may be obtained by successful completion of 12 or more semester credit hours of approved electrical engineering course work at the 300 level or above. In addition, a student seeking a minor in electrical engineering must satisfy all pre- or corequisite requirements for the courses selected. Tracks in systems science, physical electronics, digital design, and other options are available. The chief departmental advisor must approve the precise course of study. The basic course requirements for the three main tracks are as follows:

**Systems Science Track**

- ECE 371  Circuit Analysis  3
- ECE 302  Linear System Analysis  3
- ECE 304  Probability, Statistics, and Reliability  3
- Select one of the following:  3
  - ECE 451  Communication Systems
  - ECE 455  Network Engineering and Design
  - ECE 461  Automatic Control Systems

**Total Hours**  12

**Physical Electronics Track**

- ECE 304  Probability, Statistics, and Reliability  3
- ECE 323  Electromagnetics  3
- ECE 332  Microelectronic Materials and Processes  3
- Select one of the following:  3
  - ECE 472  Plasma Processing at the Nanoscale
  - ECE 473  Solid State Electronics
  - ECE 474  Optical Fiber Communication
  - ECE 478  Introduction to Lasers and Laser Applications

**Total Hours**  12

**Digital Design Track**
that employers are increasingly looking for in both engineers and scientists, in team building, interpersonal communications, decision making, ethics appropriateness to their educational objectives. The minor develops the skills Students with majors in other disciplines may also pursue this minor, chemistry, mathematics, ocean, earth and atmospheric sciences, or biology. majors in engineering, engineering technology, computer science, physics, Points of Interest this minor. obtaining a strong preparation in engineering management should consider management positions or for entrepreneurial activities. Students interested in position in technology-based, project-oriented organizations. Upon concepts useful to those aspiring to an executive/administrative management students with a set of courses that provides some of the basic management more than those having technical functions. This program provides undergraduate preparation for the Fundamentals of Engineering examination. The courses are offered both on campus and through distance learning. The program consists of 12 credits. The specified courses are as follows:

<table>
<thead>
<tr>
<th>Course</th>
<th>Requirement</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EET 350</td>
<td>Fundamentals of Electrical Technology</td>
<td>3</td>
</tr>
<tr>
<td>EET 360</td>
<td>Electrical Power and Machinery</td>
<td>3</td>
</tr>
<tr>
<td>EET 370T</td>
<td>Energy and the Environment</td>
<td>3</td>
</tr>
<tr>
<td>EET 415</td>
<td>Programmable Machine Controls</td>
<td>3</td>
</tr>
</tbody>
</table>

The digital design track is not available for computer engineering majors. For completion of a minor, a student must have a minimum overall cumulative grade point average of 2.00 in all courses required for the minor exclusive of lower-level courses, prerequisites and corequisites and complete at least six hours of upper-level courses in the minor requirement through courses offered by Old Dominion University. Completion of a minor in electrical engineering with a GPA of 3.00 or greater partially satisfies the leveling requirements for graduate degrees in electrical engineering.

**Minor in Electrical Engineering Technology**

The minor in electrical engineering technology is open to students (except electrical engineering technology majors) who have completed at least one three-credit course in calculus. It is particularly helpful for those who are preparing for the Fundamentals of Engineering examination. The courses are offered both on campus and through distance learning.

<table>
<thead>
<tr>
<th>Course</th>
<th>Requirement</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE 304</td>
<td>Probability, Statistics, and Reliability</td>
<td>3</td>
</tr>
<tr>
<td>ECE 340</td>
<td>Digital Circuits</td>
<td>4</td>
</tr>
<tr>
<td>ECE 341</td>
<td>Digital System Design</td>
<td>3</td>
</tr>
<tr>
<td>ECE 443</td>
<td>Computer Architecture</td>
<td>3</td>
</tr>
</tbody>
</table>

**Minor in Engineering Management**

**Opportunities for Employment and Graduate Studies**

According to a recent Income and Salary Survey by the National Society of Professional Engineers, the median annual income of engineers having executive/administrative job functions is approximately $20,000 higher than those having technical functions. This program provides undergraduate students with a set of courses that provides some of the basic management concepts useful to those aspiring to an executive/administrative management position in technology-based, project-oriented organizations. Upon graduation, this knowledge will help individuals qualify for project management positions or for entrepreneurial activities. Students interested in obtaining a strong preparation in engineering management should consider this minor.

**Points of Interest**

The minor in engineering management is intended for students with majors in engineering, engineering technology, computer science, physics, chemistry, mathematics, ocean, earth and atmospheric sciences, or biology. Students with majors in other disciplines may also pursue this minor, and they are encouraged to talk with their advisors to determine its appropriateness to their educational objectives. The minor develops the skills in team building, interpersonal communications, decision making, ethics and leadership, project management, risk analysis, and quality assurance that employers are increasingly looking for in both engineers and scientists, as well as in other employees in "high tech" organizations. The minor also satisfies the University's General Education upper-division requirement.

**Requirements**

Applicants for the minor in engineering management must be juniors or seniors with a declared major and a minimum GPA of 2.00. The courses can also be taken by graduate students or other graduates. The minor requires completion of 12 credit hours of course work with a minimum grade point average of 2.00 in the courses required for the minor exclusive of lower-level courses and prerequisite courses. A minimum of six hours in upper-level courses in the minor requirement must be taken through courses offered by Old Dominion University.

**Curriculum**

The course work for the minor in engineering management involves extensive writing assignments, oral presentations, and group projects, and is designed to develop the skills needed for rapid advancement in either industrial or government organizations. Twelve credit hours of course work is required to meet the requirements for the minor in engineering management. Any 300-400 level ENMA course is acceptable for the minor in engineering management. Students who intend to complete a master’s in engineering management or in systems engineering should take ENMA 420 as part of their minor requirements as it is a prerequisite to both programs.

For additional information about the undergraduate minor in engineering management, contact:

Chair
Department of Engineering Management and Systems Engineering
Old Dominion University
Norfolk, VA 23529-0248
Telephone: (757) 683-4558
FAX: (757) 683-5640

**Minor in Environmental Engineering**

An undergraduate minor in environmental engineering may be obtained by successful completion of 12 or more semester credit hours in approved environmental engineering course work at the 300 or 400 level. In addition, a student seeking a minor in environmental engineering must satisfy all prerequisite requirements for the courses selected.

Two tracks are available: aqueous environmental systems and environmental protection. The course requirements are as follows:

**Aqueous Environmental Systems**

<table>
<thead>
<tr>
<th>Course</th>
<th>Requirement</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 350</td>
<td>Environmental Pollution and Control</td>
<td>3</td>
</tr>
<tr>
<td>Select three of the following:</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>CEE 440</td>
<td>Hydraulic Engineering</td>
<td></td>
</tr>
<tr>
<td>CEE 446</td>
<td>Urban Stormwater Hydrology</td>
<td></td>
</tr>
<tr>
<td>CEE 447</td>
<td>Groundwater Hydraulics</td>
<td></td>
</tr>
<tr>
<td>CEE 450</td>
<td>Water Distribution and Wastewater Collection System Design</td>
<td></td>
</tr>
<tr>
<td>CEE 451</td>
<td>Water and Wastewater Treatment</td>
<td></td>
</tr>
<tr>
<td>CEE 460</td>
<td>Advanced Analytical Techniques in Environmental Engineering</td>
<td></td>
</tr>
<tr>
<td>CEE 482</td>
<td>Introduction to Coastal Engineering</td>
<td></td>
</tr>
</tbody>
</table>

**Environmental Protection**

<table>
<thead>
<tr>
<th>Course</th>
<th>Requirement</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE 350</td>
<td>Environmental Pollution and Control</td>
<td>3</td>
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<tr>
<td>Select three of the following:</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>CEE 451</td>
<td>Water and Wastewater Treatment</td>
<td></td>
</tr>
<tr>
<td>CEE 452</td>
<td>Air Quality</td>
<td></td>
</tr>
<tr>
<td>CEE 454</td>
<td>Hazardous Waste Treatment</td>
<td></td>
</tr>
<tr>
<td>CEE 458</td>
<td>Sustainable Development</td>
<td></td>
</tr>
<tr>
<td>CEE 459</td>
<td>Biofuels Engineering</td>
<td></td>
</tr>
</tbody>
</table>

Old Dominion University
For completion of a minor a student must have a minimum overall cumulative grade point average of 2.00 in courses required for the minor exclusive of lower-level courses, prerequisites and corequisites and complete at least six hours of upper-level courses in the minor requirement through courses offered by Old Dominion University.

**Minor in Mechanical Engineering**

The Department of Mechanical and Aerospace Engineering offers a minor program with two emphases: thermal sciences and mechanics.

The specific minimum courses required are as follows:

**Thermal Sciences**
- MAE 303: Mechanics of Fluids 3
- MAE 311: Thermodynamics I 3
- MAE 312: Thermodynamics II 3
- or MAE 414: Introduction to Gas Dynamics 3
- MAE 315: Heat and Mass Transfer 3

**Total Hours** 12

**Mechanics**
- MAE 332: Mechanical Engineering Design I 3
- MAE 340: Computational Methods in Mechanical Engineering 3
- MAE 404: Vibrations 3
- MAE 436: Dynamic Systems and Control 3

**Total Hours** 12

It may be possible to substitute other appropriate junior- or senior-level mechanical engineering courses for those specified above with prior approval of the department. Exceptions are rare and are not encouraged. All prerequisites and corequisites must be satisfied for all courses taken.

For completion of a minor, a student must have a minimum overall cumulative grade point average of 2.00 in all courses required for the minor exclusive of lower-level courses, prerequisites and corequisites and complete at least six hours in upper-level courses in the minor requirement through courses offered by Old Dominion University.

**Minor in Mechanical Engineering Technology**

The minor in mechanical engineering technology is open to students (except mechanical engineering and mechanical engineering technology majors) who have completed at least one three-credit course in calculus. It is particularly helpful for those who are preparing for the Fundamentals of Engineering examination. The courses are offered both on campus and through distance learning.

The program consists of 12 credits and the specified courses are as follows:

- MET 300: Thermodynamics 3
- MET 310: Dynamics 3
- MET 330: Fluid Mechanics 3
- MET 350: Thermal Applications 3

**Total Hours** 12

Certain substitutions are possible if suitable justification is provided.

For completion of a minor, a student must have a minimum overall cumulative grade point average of 2.00 in all courses required for the minor exclusive of lower-level courses, prerequisites and corequisites and complete at least six hours in upper-level courses in the minor requirement through courses offered by Old Dominion University.

**Minor in Military Leadership**

The minor in military leadership is a high quality, interdisciplinary, multidimensional, experiential, and culturally diverse program that exposes students to, and prepares them for, real life leadership opportunities and challenges. Students explore issues of leadership, citizenship, and social change within the context of an inquiry, experiential, and competency-based instructional design. The minor is open to all students who have

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**Minor in Marine Engineering**

The minor in marine engineering is open to all students with the exception of those students in the Mechanical Engineering Technology program's Marine Engineering option. Students seeking the minor must satisfy all pre- or corequisite requirements for the courses selected. The minor is multidisciplinary and consists of four courses in topics that are relevant to the shipbuilding, maintenance, repair and maritime operations industries.

The specific minimum courses required are as follows:

- MET 475: Marine Engineering I 3
- MET 476: Marine Engineering II 3
- MAE 450: Principles of Naval Architecture 3
- MAE 417: Propulsion Systems 3

**Total Hours** 12

For completion of a minor, a student must have a minimum overall grade point average of 2.00 in all courses required for the minor exclusive of lower-level courses, prerequisites and corequisites and complete at least six hours of upper-level courses in the minor requirement through courses offered by Old Dominion University.

**Minor in Global Engineering**

The minor in global engineering is for students who plan to seek career opportunities in companies with global operations. With globalization of design and manufacturing, it has become important for engineers, engaged in transnational projects, to not only have better teamwork and communication skills, but also a good understanding of the socioeconomic, environmental and cultural aspects of global engineering projects. The global engineering minor provides an understanding of these aspects through courses that develop an understanding of global technology, quality assurance standards, and differences in cultural, communication and business practices in a global work environment.

Students may obtain a minor in global engineering by successful completion of 12 semester credit hours in approved course work at the 300- or 400-level. In addition, a student seeking a minor in global engineering must satisfy all pre- or corequisite requirements for the courses selected. The requirements are as follows:

- CEE 458: Sustainable Development 3
- CEE 367: Cooperative Education 3
- or ECE 367: Cooperative Education 3
- or MAE 367: Cooperative Education 3

Select two from the following:

- GEOG 305: World Resources 3
- ENGL 371W: Communication Across Cultures 3
- MKTG 411: Multi-National Marketing 3

**Total Hours** 12

* Preferably at a multinational company.

For completion of a minor, a student must have a grade point average of 2.00 in all courses required for the minor exclusive of lower-level courses, prerequisites and corequisites and complete at least six hours in upper-level courses in the minor requirement through courses offered by Old Dominion University.

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<table>
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<tr>
<th>Course</th>
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<td>Thermodynamics II</td>
</tr>
<tr>
<td>or MAE 414</td>
<td>Introduction to Gas Dynamics</td>
</tr>
<tr>
<td>MAE 315</td>
<td>Heat and Mass Transfer</td>
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</tbody>
</table>

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<tbody>
<tr>
<td>MAE 332</td>
<td>Mechanical Engineering Design I</td>
</tr>
<tr>
<td>MAE 340</td>
<td>Computational Methods in Mechanical Engineering</td>
</tr>
<tr>
<td>MAE 404</td>
<td>Vibrations</td>
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<td>MAE 436</td>
<td>Dynamic Systems and Control</td>
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<tbody>
<tr>
<td>MET 300</td>
<td>Thermodynamics</td>
</tr>
<tr>
<td>MET 310</td>
<td>Dynamics</td>
</tr>
<tr>
<td>MET 330</td>
<td>Fluid Mechanics</td>
</tr>
<tr>
<td>MET 350</td>
<td>Thermal Applications</td>
</tr>
</tbody>
</table>

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<table>
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</tr>
<tr>
<td>or ECE 367</td>
<td>Cooperative Education</td>
</tr>
<tr>
<td>or MAE 367</td>
<td>Cooperative Education</td>
</tr>
</tbody>
</table>

Select two from the following:

- GEOG 305: World Resources |
- ENGL 371W: Communication Across Cultures |
- MKTG 411: Multi-National Marketing |

| Total Hours | 12 |
---|---|

---

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MET 475</td>
<td>Marine Engineering I</td>
</tr>
<tr>
<td>MET 476</td>
<td>Marine Engineering II</td>
</tr>
<tr>
<td>MAE 450</td>
<td>Principles of Naval Architecture</td>
</tr>
<tr>
<td>MAE 417</td>
<td>Propulsion Systems</td>
</tr>
</tbody>
</table>

| Total Hours | 12 |
---|---|

---

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>MET 300</td>
<td>Thermodynamics</td>
</tr>
<tr>
<td>MET 310</td>
<td>Dynamics</td>
</tr>
<tr>
<td>MET 330</td>
<td>Fluid Mechanics</td>
</tr>
<tr>
<td>MET 350</td>
<td>Thermal Applications</td>
</tr>
</tbody>
</table>

| Total Hours | 12 |
---|---|
completed the prerequisite courses. Students who are not enrolled in the military science or naval science program will receive academic credit for commissioning purposes.

The requirements for students in the Naval Science Department are completion of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAVS 302</td>
<td>Navigation and Naval Operations II</td>
<td>3</td>
</tr>
<tr>
<td>or NAVS 410</td>
<td>Amphibious Warfare</td>
<td>3</td>
</tr>
<tr>
<td>NAVS 301</td>
<td>Navigation and Naval Operations I</td>
<td>3</td>
</tr>
<tr>
<td>or NAVS 310</td>
<td>Evolution of Warfare</td>
<td>3</td>
</tr>
<tr>
<td>or NAVS 320</td>
<td>Naval Sea Power</td>
<td>3</td>
</tr>
<tr>
<td>NAVS 401</td>
<td>Leadership and Management I</td>
<td>3</td>
</tr>
<tr>
<td>NAVS 402</td>
<td>Leadership and Ethics</td>
<td>3</td>
</tr>
<tr>
<td>Select one of the following:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENMA 301</td>
<td>Introduction to Engineering Management</td>
<td>3</td>
</tr>
<tr>
<td>ENMA 401</td>
<td>Project Management</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 435W</td>
<td>Management Writing</td>
<td>3</td>
</tr>
<tr>
<td>HIST 360</td>
<td>American Military History</td>
<td>3</td>
</tr>
<tr>
<td>HIST 408</td>
<td>War and American Society in the Twentieth Century</td>
<td>3</td>
</tr>
<tr>
<td>MGMT 325</td>
<td>Contemporary Organizations and Management</td>
<td>3</td>
</tr>
<tr>
<td>MGMT 340</td>
<td>Human Resources Management</td>
<td>3</td>
</tr>
<tr>
<td>NURS 480W</td>
<td>Nursing in the Health Care System: Leadership</td>
<td>3</td>
</tr>
<tr>
<td>PHIL 441</td>
<td>Foundations of Ethics</td>
<td>3</td>
</tr>
<tr>
<td>PHIL 442E</td>
<td>Studies in Applied Ethics</td>
<td>3</td>
</tr>
<tr>
<td>POLS 326W</td>
<td>American Foreign Policy</td>
<td>3</td>
</tr>
<tr>
<td>POLS 327W</td>
<td>Politics of National Security</td>
<td>3</td>
</tr>
<tr>
<td>POLS 350T</td>
<td>Technology and War</td>
<td>3</td>
</tr>
<tr>
<td>POLS 421</td>
<td>International Law</td>
<td>3</td>
</tr>
<tr>
<td>PSYC 343</td>
<td>Personnel Psychology</td>
<td>3</td>
</tr>
<tr>
<td>PSYC 345</td>
<td>Organizational Psychology</td>
<td>3</td>
</tr>
<tr>
<td>SOC 352</td>
<td>War and Peace</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Hours</strong></td>
<td></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

For completion of a minor, a student must have a minimum overall cumulative grade point average of 2.00 in all courses required for the minor exclusive of lower-level courses and prerequisite courses and complete a minimum of six hours in upper-level courses in the minor requirement through courses offered by Old Dominion University.

**Minor in Modeling and Simulation**

An undergraduate minor in modeling and simulation may be obtained by successful completion of 12 or more credit hours of approved modeling and simulation engineering coursework at the 200-, 300-, and 400-level. In addition, a student seeking a minor in modeling and simulation must satisfy all pre- or corequisite requirements for the courses selected.

There are two tracks available in the minor in modeling and simulation: simulation application and simulation development. The chief departmental advisor for the Department of Modeling, Simulation and Visualization Engineering must approve the precise course of study in the minor.

The basic course requirements for the two tracks are as follows:

**Simulation Application Track**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 330</td>
<td>An Introduction to Probability and Statistics (or equivalent)</td>
<td>3</td>
</tr>
<tr>
<td>MSIM 205</td>
<td>Discrete Event Simulation</td>
<td>3</td>
</tr>
<tr>
<td>MSIM 320</td>
<td>Continuous Simulation</td>
<td>3</td>
</tr>
<tr>
<td>and three hours selected from either</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>MSIM 410</td>
<td>Model Engineering</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Hours</strong></td>
<td></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

**Simulation Development Track**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 330</td>
<td>An Introduction to Probability and Statistics (or equivalent)</td>
<td>3</td>
</tr>
<tr>
<td>MSIM 205</td>
<td>Discrete Event Simulation</td>
<td>3</td>
</tr>
<tr>
<td>MSIM 331</td>
<td>Simulation Software Design</td>
<td>3</td>
</tr>
<tr>
<td>MSIM 408</td>
<td>Introduction to Game Development</td>
<td>3</td>
</tr>
<tr>
<td>MSIM 441</td>
<td>Computer Graphics and Visualization</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Hours</strong></td>
<td></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

When appropriate, other course work can be developed in consultation with the chief departmental advisor.

For completion of the minor, a student must pass each course required for the minor, achieve a cumulative grade point average of 2.00 for all courses required for the minor exclusive of lower-level courses, prerequisites and corequisites, complete a minimum of twelve credit hours of approved coursework for the minor, and complete at least six hours of upper-level courses in the minor requirement through courses offered by Old Dominion University. To enter the program, students must have completed calculus and one college-level computer-programming course (CS 150 or equivalent). For further information contact the Department of Modeling, Simulation, and Visualization Engineering (http://catalog.odu.edu/previous/2015-2016/undergraduate/frankbattencollegeofengineeringandtechnology/modelingsimulationvisualizationengineering).

**Minor in Motorsports Engineering**

The Department of Mechanical and Aerospace Engineering offers a minor program in motorsports engineering. The minor is multidisciplinary and consists of four courses in topics that are relevant to the motorsports and automotive industries. Each course is practice-oriented and consists of integrated lectures and laboratories.

The course requirements are as follows:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAE 407</td>
<td>Ground Vehicle Aerodynamics</td>
<td>3</td>
</tr>
<tr>
<td>MAE 457</td>
<td>Motorsports Vehicle Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>or MET 427</td>
<td>Mechatronic System Design</td>
<td>3</td>
</tr>
<tr>
<td>MAE 467</td>
<td>Racecar Performance</td>
<td>3</td>
</tr>
<tr>
<td>MET 480</td>
<td>High Performance Piston Engines</td>
<td>3</td>
</tr>
<tr>
<td>or MAE 477</td>
<td>High Performance Piston Engines</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Hours</strong></td>
<td></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

It may be possible to substitute other appropriate senior-level mechanical and aerospace or engineering technology courses with prior approval of the Mechanical and Aerospace Engineering Department, but substitutions are rare. The minor in motorsports engineering is open to all students. All prerequisites and corequisites must be satisfied for all courses taken.

For completion of a minor, a student must have a minimum overall cumulative grade point average of 2.00 in all courses required for the minor exclusive of lower-level courses, prerequisites and corequisites and complete at least six hours in upper-level courses in the minor requirement through courses offered by Old Dominion University.