

Aerospace Minor

The Mechanical and Industrial Engineering Department offers a nonteaching Aerospace Minor. This minor provides a suite of courses from a wide variety of disciplines which are relevant to aerospace. The minor requires a minimum of 31 credits. Required courses comprise 16 credits in four (4) specified courses, which are common to Mechanical Engineering, Electrical Engineering, Physics, Civil Engineering, Chemical Engineering, Chemistry, and Industrial & Management Systems Engineering at MSU Bozeman. An additional required course, EMEC 368 Introduction to Aerospace, is the cornerstone, foundational course for the Aerospace Minor. An additional 12 elective credits (minimum of four courses) are required from a specified list which comprises the Aerospace Elective Courses. This minor is a useful complement to majors in science or engineering for those seeking a cross-disciplinary academic program with topics in aerospace. The required courses are carefully selected to ensure that students seeking the Aerospace Minor at MSU have the requisite math and science background to engage in specific applications to aerospace. The Aerospace Elective Courses were developed to provide students with the minimum background of specific topics applicable to aerospace. These are **Materials and Structures** (needed for development of aerospace systems; structures, hardware, sensors, system packages, etc.), **Thermo/Fluids** (needed for an understanding of aeronautical systems, momentum equations relevant to propulsion systems, environmental needs, etc.), and **Focused Topics** (a series of focused and advanced topics applicable to aerospace. These courses include design, dynamics and control, Computer Aided Design (CAD), space science, etc.) The Certifying Officer for the Aerospace Minor is the current MSU Lysle A. Wood Distinguished Professor, and students with questions are encouraged to seek him/her by contacting the MSU Mechanical & Industrial Engineering Department.

The MSU **Aerospace Minor = 19 required credits + 12 minimum elective credits = 31 minimum course credits for the Aerospace Minor**; In some cases, this may be accomplished within the maximum 128 credits for certain B.S. degrees at MSU (with the Aerospace Minor inclusive). Students who have less than 19 course credits will fill the additional minimum 28 course credits with approved Aerospace Minor elective course credits. Students seeking a degree in ME or MET cannot use EMEC 368 as a Professional Elective for their major degree requirements.

Notes: The following constraints will be imposed on Aerospace Minor Courses:

- **IF A COURSE (or redundant equivalent) IS A SPECIFICALLY REQUIRED COURSE FOR THE STUDENT'S MAJOR DEGREE PROGRAM, IT WILL NOT BE ACCEPTED AS AN AEROSPACE MINOR ELECTIVE.**
- Additional Clarification: Elective courses in a student's major degree program are not considered as required courses and can, therefore, be used as Aerospace Minor electives. Pre-requisites for courses will be enforced.
- An appeal to include additional classes for the Aerospace Minor can be made if the student/instructor can make a cogent argument as to how the course is relevant to aerospace. That includes relevant 5xx-level and 6xx-level classes.
- All academic policies relevant to MSU are in effect for the Aerospace minor; in particular, all courses used to fulfill the minor must have a grade of C- or better.

Required Courses

or acceptable substitute for Aerospace Minor courses listed below *		
M 171Q	Calculus I	3-4
or M 165Q	Calculus for Technology I	

M 172	Calculus II	4
or M 166	Calculus for Technology II	
PHSX 220	Physics I with Calculus	4
or PHSX 205	College Physics I	
PHSX 222	Physics II with Calculus	4
or PHSX 207	College Physics II	
EMEC 368	Introduction to Aerospace	3
Credit Sub-Total		17-19

Aerospace Minor Courses

Students take one course from each category below, plus one additional course from any of the three categories (Materials and Structures, Thermo/Fluids, Focused Topics). 12-16

Materials and Structures

Choose at least one from the following:

EELE 409	EE Material Science
EMAT 350	Engineering Materials
EMAT 460	Polymeric Materials
EMAT 461	Fricition and Wear of Materials
EMAT 462	Manufacturing of Composites
EMAT 463	Composite Materials
EMEC 405	Finite Element Analysis
EMEC 444	Mech Behavior of Materials
EMEC 447	Aircraft Structures

Thermo/Fluids

Choose at least one from the following:

ECHM 424	Transport Analysis
EGEN 324	Applied Thermodynamics
EGEN 335	Fluid Mechanics
EGEN 435	Fluid Dynamics
EMEC 326	Fundamentals of Heat Transfer
EMEC 425	Advanced Thermal Systems
EMEC 426	Thermodynamics of Propulsion Systems
EMEC 430	Introduction to Combustion
EMEC 436	Computational Fluid Dynamics
ETME 423	Principles of HVAC II
ETME 430	Fluid Power Systems Design

Focused Topics

Choose at least one from the following:

EELE 308	Signals and Systems Analysis
EELE 321	Introduction To Feedback Controls
EELE 407	Intro To Microfabrication
EELE 422	Intro to Modern Control
EELE 447	Mobile Wireless Communications
EELE 465	Microcontroller Applications
EELE 481	Optical Design
EELE 482	Electro-Optical Systems
EELE 484	Laser Engineering
EGEN 310R	Multidisciplinary Engineering Design (non-Engineering majors only)
EGEN 365	Introduction to Mechatronics
EGEN 415	Advanced Mechanics of Solids
EIND 371	Introduction to Computer Integrated Manufacturing
EIND 413	Ergonomics & Human Factors Engineering
EIND 422	Introduction to Simulation

EIND 434	Project Management for Engineers
EIND 477	Statistical Quality Control
EMEC 403	CAE IV--Design Integration
EMEC 462	System Dynamics and Control
EMEC 466	Acoustics, Engineering and the Environment
EMEC 467	Micro-Electromechanical Systems
ETME 410	Computerized Numerical Control and Computer-aided Manufacturing Technology
ETME 415	Design for Manufacturing and Tooling
ETME 462	Industrial Processing Automation and Controls
PHSX 427	Advanced Optics
PHSX 435	Astrophysics
PHSX 437	Laser Applications
Total Credits	31

* Acceptable substitute is defined as meeting the pre-requisites for the specific course in Aerospace Minor courses listed above, or as allowed by the instructor as an acceptable pre-requisite for the given Aerospace Minor course.