Aerospace Minor

The Mechanical and Industrial Engineering Department within the Norm Asbjornson College of Engineering offers a nonteaching minor in aerospace called the 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.

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	Friction 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	
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	Quality Management Systems	
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.

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.