ASTRONOMY - UNDERGRADUATE MINOR

The department offers a minor created for majors in a variety of scientific fields, and two minor emphases specifically designed to address the needs and interests of students from the Colleges of Education and Engineering. Any undergraduate, however, may pursue any of the three minor tracks.

Requirements

The requirements for the regular minor requires 19 credits, from the following:

Prefix	Title	Credits
Requirements		
ASTR 1115G	Introduction to Astronomy Lecture & Laboratory	4
or ASTR 1120G	The Planets Lecture & Laboratory	
Select two from the following: [1]		6
ASTR 301V	Revolutionary Ideas in Astronomy	
ASTR 305V	The Search for Life in the Universe	
ASTR 308V	Into the Final Frontier	
Select 9 credits between the following groups: [2]		9
Group A		
Select 6-9 credits from the following: [2]		
ASTR 401	Topics in Modern Astrophysics	
ASTR 402	Astronomical Observations and Techniques	
Group B		
Select 3-9 credits from the following: [2,4]		
A E 424	Aerospace Systems Engineering	
BIOL 451	Physiology of Microorganisms	
BIOL 467	Evolution	
BIOL 473	Ecology of Microorganisms	
C S 475	Artificial Intelligence I	
C S 482	Database Management Systems I	
C S 491	Parallel Programming	
CHEM 431	Physical Chemistry	
CHEM 433	Physical Chemistry I	
E E 395	Introduction to Digital Signal Processing	
E E 400	Undergraduate Research	
E E 444	Advanced Image Processing	
E E 446	Digital Image Processing	
E E 454	Antennas and Radiation	
E E 460	Space System Mission Design and Analysis	
E E 465	Machine Learning I	
E E 473	Introduction to Optics	
E E 478	Fundamentals of Photonics	
ENGR 401	Engineering Capstone I	
ENGR 402	Engineering Capstone II	
GEOL 465	Isotope Geochemistry	
MATH 4210	Complex Variables	
MATH 4220	Fourier Series and Boundary Value Problems	
PHYS 451	Intermediate Mechanics I	
PHYS 461	Intermediate Electricity and Magnetism I	
PHYS 480	Thermodynamics	
STAT 3110	Statistics for Engineers and Scientists	
STAT 4210	Probability: Theory and Applications	
STAT 4220	Statistics: Theory and Applications	
Total Credits		**19**

1. Three credits of ASTR 400 Undergraduate Research may replace one of these courses.
2. ASTR 401 Topics in Modern Astrophysics and ASTR 402 Astronomical Observations and Techniques are the preferred classes but are generally offered only in alternate years. Three credits of ASTR 400 Undergraduate Research may replace one of these courses, but not the same three if used above.
3. Cross-listed with graduate classes and require special permission.
4. Alternative 400-level courses in the physical sciences, engineering, or related fields, including one-time seminars, may be proposed on a case-by-case basis to fulfill this requirement, drawn from the fields of astronomy, biochemistry, biology, chemistry, computer science, geology, geophysics, mathematics, physics, statistics or from engineering. Proposals should include a clear justification that connects the course materials to a particular topic in astronomy or astrophysics.

Emphasis: Education

The requirements for the education track minor requires 18-20 credits from the following:

Prefix	Title	Credits
ASTR 1115G	Introduction to Astronomy Lecture & Laboratory	4
ASTR 1120G	The Planets Lecture & Laboratory	4
Select two from the following:		6
ASTR 301V	Revolutionary Ideas in Astronomy	
ASTR 305V	The Search for Life in the Universe	
ASTR 308V	Into the Final Frontier	
Select 4-6 credits from the following: [5]		4-6
ASTR 400	Undergraduate Research	
ASTR 401	Topics in Modern Astrophysics	
ASTR 402	Astronomical Observations and Techniques	
EDUC 4310	Methods of Teaching Elementary School Science	
EDUC 4410	Teaching Science at the Middle and High School Level	
Total Credits		**18-20**

5. This requirement will generally be fulfilled by two 3-credit courses. Students may request the 4 credit option instead, if an appropriate topic and instructor for 1 credit of ASTR 400 Undergraduate Research are available. ASTR 401 Topics in Modern Astrophysics and ASTR 402 Astronomical Observations and Techniques are generally offered only in alternate years, and have prerequisites.

Emphasis: Engineering

The requirements for the engineering track minor requires 18-19 credits from the following:

Prefix	Title	Credits
Required Courses		
Select 3-4 credits from the following:		3-4
ASTR 1115G	Introduction to Astronomy Lecture & Laboratory	

ASTR 1120G	The Planets Lecture & Laboratory	
PHYS 1310G	Calculus -Based Physics I	
PHYS 1320G	Calculus -Based Physics II	
Select one from the following:		3
ASTR 301V	Revolutionary Ideas in Astronomy	
ASTR 305V	The Search for Life in the Universe	
ASTR 308V	Into the Final Frontier	
Select 12 credits from the following two groups:		12
Group A		
Select 6-9 credits from the following: [6]		
A E 428	Aerospace Capstone Design	
ASTR 400	Undergraduate Research	
ASTR 401	Topics in Modern Astrophysics [7]	
ASTR 402	Astronomical Observations and Techniques [7]	
E E 400	Undergraduate Research	
M E 400	Undergraduate Research	
Group B		
Select 3-6 credits from the following: [9]		
A E 424	Aerospace Systems Engineering	
BIOL 451	Physiology of Microorganisms	
BIOL 467	Evolution	
BIOL 473	Ecology of Microorganisms	
C S 475	Artificial Intelligence I	
C S 482	Database Management Systems I	
C S 491	Parallel Programming	
CHEM 431	Physical Chemistry	
CHEM 433	Physical Chemistry I	
E E 454	Antennas and Radiation	
E E 460	Space System Mission Design and Analysis	
E E 473	Introduction to Optics	
E E 478	Fundamentals of Photonics	
GEOL 465	Isotope Geochemistry	
MATH 4210	Complex Variables	
MATH 4220	Fourier Series and Boundary Value Problems	
PHYS 451	Intermediate Mechanics I	
PHYS 461	Intermediate Electricity and Magnetism I	
PHYS 480	Thermodynamics	
STAT 3110	Statistics for Engineers and Scientists	
STAT 4210	Probability: Theory and Applications	
STAT 4220	Statistics: Theory and Applications	
Total Credits		**18-19**

[6] Taking any of the non-astronomy classes for this requirement requires prior approval from the head of astronomy on a case-by-case basis, with a clear connection being established between the proposed research or design project and a particular topic in astronomy or astrophysics (astronomy instrumentation or observational projects are particularly encouraged); no more than 3 non-ASTR credits can be counted toward the minor.

[7] Generally offered in alternate years.

[8] Cross-listed with graduate classes and require special permission.

[9] Alternative 400-level courses in the physical sciences, engineering, or related fields, including one-time seminars, may be proposed on a case-by-case basis to fulfill this requirement, drawn from the fields of astronomy, biochemistry, biology, chemistry, computer science, geology, geophysics, mathematics, physics, statistics, or from engineering. Proposals should include a clear justification that connects the course materials to a particular topic in astronomy or astrophysics.