

THE UNIVERSITY OF NORTH CAROLINA AT ASHEVILLE
FACULTY SENATE

Senate Document Number 1117S
Date of Senate Approval 01/19/17

Statement of Faculty Senate Action:

APC Document 8 (ASTR): Delete ASTR 101 and 111, replacing with ASTR 102, 103, 112, and 113;
Add ASTR 301;
Delete ASTR 321, 322, replacing with ASTR 321;
Delete ASTR 411, 412, replacing with ASTR 320 and ASTR 420;
Delete ASTR 430, 431, replacing with ASTR 430

Effective Date: Fall 2017

1. Delete: On page 87, the entries for **ASTR 101 and ASTR 111:**

101 Astronomy (3)

A course for the general student covering the historical development of astronomy, the solar system and its formation, stars and their evolution, galaxies and cosmology. Additional topics include fundamental forces in nature, nuclear reactions, origin of the elements, atomic spectra, and black holes. If ASTR 111 is also taken, the courses will satisfy the LAC Laboratory Science requirement. No credit given to students who have credit for ASTR 105. Fall and Spring.

111 Astronomy Lab (1)

A laboratory course to introduce the student to observational and measurement methods employed in the field of astronomy. Pre- or corequisite: ASTR 101. Fall and Spring.

Add: On page 87, in place of deleted entries:

102 Introduction to Astronomy: The Solar System (3)

An introductory course covering the formation, characteristics, and motions of objects in our solar system. Additional topics include the historical development of astronomy, extra-solar planets, and telescopes. No credit given to students who have credit for ASTR 101 or ASTR 105. Fall.

103 Introduction to Astronomy: Stars and Galaxies (3)

An introductory course covering stars and their evolution, galaxies, and cosmology. Additional topics include fundamental forces in nature, nuclear reactions, origin of the elements, atomic spectra, and black holes. No credit given to students who have credit for ASTR 101 or 105. Spring.

112 Astronomy Lab I (1)

A laboratory course using observational and measurement methods employed in the field of astronomy. Students will observe the current sky with additional emphasis on solar system objects and the techniques used to study them. No credit given to students who have credit for ASTR 111. Pre- or corequisite: ASTR 102 or 103. Fall.

113 Astronomy Lab II (1)

A laboratory course using observational and measurement methods employed in the field of astronomy. Students will observe the current sky with additional emphasis on galactic and extra-galactic objects and the techniques used to study them. No credit given to students who have credit for ASTR 111. Pre- or corequisite: ASTR 102 or 103. Spring.

Impact Statement: There will be no impact on teaching resources. ASTR 101 and 111 were offered every semester. ASTR 102/112 will replace 101/111 in the fall and ASTR 103/113 will replace it in the spring.

Rationale: The amount of material in introductory astronomy is too much for one semester, resulting in a superficial treatment of many of the topics. Many, if not most, colleges and universities with astronomy curricula offer two introductory courses, one focusing on the solar system and the second on stars and galaxies. Having two introductory courses will provide a better foundation for students choosing to minor in astronomy, while still providing an astronomy course every semester for students who wish to take it out of interest and/or to fulfill the LAC science requirements.

2. **Add:** On page 87, new course, **ASTR 301:**

301 Indigenous Perspectives on the Sky (4)

Astronomy is the oldest science; it is also inherently interdisciplinary, as astronomical phenomena can be found interwoven within the economics, politics, art, religion and rituals, and philosophies of all civilizations. This course will explore how non-Western and indigenous peoples have observed, conceptualized, and utilized the celestial patterns in the sky. Special emphasis will be placed on the cosmography and astronomical knowledge of the Eastern Band of Cherokee Indians and other indigenous peoples from the Americas. The course will include numerous invited talks from tribal elders, along with substantial reading and discussions. Contextualization of the indigenous cosmographies presented in class will be achieved in the accompanying laboratory component, which will focus on semester-long naked-eye observations of celestial motions. Odd years Fall.

Impact Statement: This course is designed for the upper-level student with interests in astronomy but not necessarily a background in (or plans to pursue) upper-level math and physical science. The cultural perspectives offered by the course provide a unique interdisciplinary offering for physical science majors, while offering a similarly unique laboratory science credit for students in other fields. The course further provides an opportunity for UNCA to build a collection of indigenous aural histories related to astronomy (i.e., primary source ethnoastronomy). The course will require an addition of 6 faculty contact hours over two years, which will be shared between the faculties of Physics and **Modern Languages and Literatures**.

Rationale: This course builds on UNCA's strong relationship with the Eastern Band of Cherokee Indians and provides a uniquely attractive laboratory science opportunity for Interdisciplinary Studies majors. Note: Launching the course in Fall 2017 would be particularly significant, given the upcoming total solar eclipse (a phenomenon notably predicted with unmatched precision by the Mayan civilization).

3. **Delete:** On page 87, the entry for **ASTR 321, 322:**

321, 322 Astrophysics I, II (3, 3)

Physical processes applied to astronomical phenomena, including interstellar medium, star and planet formation, stellar structure and evolution, atmospheric structure, nebulae, galaxies, black holes, and evolution of the universe. ASTR 321 prerequisites: ASTR 101, 111; PHYS 222. ASTR 322 prerequisite: ASTR 321. ASTR 321: Odd years Fall. ASTR 322: Even years Spring.

Add: On page 87, in place of deleted entry:

321 Astrophysics (3)

Physical processes applied to astronomical phenomena, including star formation, stellar structure and evolution, and compact stellar remnants. The interstellar medium, from which stars form, will also be examined. Prerequisites: ASTR 103 and PHYS 221. Pre- or corequisite: PHYS 222 or 231. Even years Spring.

Impact Statement: This course replaces a two-semester astrophysics sequence, and therefore does not require additional faculty resources. As part of the revised Minor in Astronomy, it applies basic physical principles to known astrophysical phenomena, such as those described qualitatively in ASTR 103.

Rationale: For students pursuing a research oriented path, this course provides the core methodology in quantitative application of physical principles to the universe.

Note: ASTR 103, but not ASTR 102, is listed as a prerequisite because this course would be mainly based on the material in ASTR 103 (stars). Although the expectation is that most students would have taken both semesters of Introduction to Astronomy, going with the minimum prerequisite is recommended to simplify dealing with unique situations that will inevitably arise.

4. **Delete:** On page 87, the entry for **ASTR 411, 412**

411, 412 Observational Astronomy I, II (1, 1)

Advanced techniques in observational astronomy. Students will carry out a research project, either in optical or radio astronomy. They will give written and oral reports of their results at the end of the semester. ASTR 411 prerequisite: ASTR 101, 111. ASTR 412 prerequisite: ASTR 411. ASTR 411: Even years Fall. ASTR 412: Odd years Spring.

Add: On page 87, in place of deleted entry:

320 Observational Astronomy I (4)

Provides a broad introduction to methods in observational astronomy, including techniques used to measure a wide range of observable astrophysical processes across the electromagnetic spectrum (from gamma rays to radio astronomy). The lab component of the course focuses on project-based investigations on topics of the students' choosing, utilizing the optical capabilities of the university telescope at Lookout Observatory. Prerequisite: ASTR 112 or 113. Fall.

420 Observational Astronomy II (3)

Provides an introduction to computational methods in observational astronomy. The class will be structured as a project-based exploration of professional astronomy data. No previous computing experience is required, but the course content will rely heavily on computer-based projects. The course includes an introduction to basic command-line programming (Unix and Python), statistical analysis, and data visualization, all placed within the context of astrophysical investigations. Prerequisites: ASTR 320. Odd years Spring.

Impact Statement: ASTR 320, Observational Astronomy I, provides a hands-on exploration of the basic techniques used to observe and quantify known astrophysical phenomena, as described in ASTR 102 and ASTR 103. ASTR 420, Observational Astronomy II, builds on Observational Astronomy I by incorporating the fundamental computing skills required to undertake projects using data from modern professional telescopes. The latter course will be particularly useful to research-oriented students, who may be considering graduate school in physics, astronomy, or computer science. The proposed changes will increase the faculty contact hours for Observational Astronomy I from 3 to 6 hours and the student credit hours from 1 to 4. The physics department can absorb this increase in contact hours with the current level of staffing. The increase in credit hours from 1 to 3 reflects the need for a more substantial lecture component, in which to introduce new concepts and build the students' computational skills.

Rationale: The hands-on nature of Observational Astronomy I is designed to cultivate scientific curiosity and critical thinking in a manner appropriate for all students with a basic knowledge of astronomy, regardless of their research orientation. The current version of this course is running in an under-resourced capacity due to the time-intensive project-based nature of the course and its increasing student enrollments. Increasing the credit hours from 1 to 4 will enable the addition of a much needed lecture component, in which to lay the scientific and technical foundations students need to effectively design and carry out their projects. The substantial time investments by students enrolled in previous semesters of ASTR 411 further justifies an increase in credit hours.

Modern observational astronomy requires a basic familiarity with coding in order to interface with digital datasets of ever-increasing scale. Observational Astronomy II provides students with the opportunity to obtain these fundamental skills via open-ended explorations of authentic astrophysical data. Note that the course is scheduled for the Spring term, when weather conditions are suboptimal for utilizing the university telescope.

5. **Delete:** On page 88, the entry for **ASTR 430, 431**

430, 431 Advanced Topics in Astronomy I, II (3, 3)

Examination of a current development in advanced astronomy. Areas covered may include cosmology, stellar astronomy, gamma ray bursts, black holes, radio and optical astronomy. ASTR 430 prerequisites: ASTR 101, 111; PHYS 222. ASTR 431 prerequisite: ASTR 430. ASTR 430: Even years Fall. ASTR 431: Odd years Spring.

Add: On page 88, in place of deleted entry:

430 Black Holes and Cosmology (3)

Basic gravitational physics of black holes, and the large scale evolution of the universe, including evidence for the Big Bang Model. Galaxies and the intergalactic medium will be an essential part of this discussion. Prerequisites: ASTR 103 and PHYS 221. Pre- or corequisite: PHYS 222 or 231. Even years Fall.

Impact Statement: This course replaces the courses Advanced Topics in Astronomy I and II, and therefore does not require additional faculty resources. As part of the revised Minor in Astronomy, it introduces students to the frontiers of modern astrophysics through application of fundamental physical concepts to black holes, galaxies, the intergalactic medium, and the curvature and expansion of the universe. Black holes and cosmology was the topic for ATMS 430 when it was previously taught, so a new number isn't needed.

Rationale: For students pursuing a research oriented path, this course employs basic physical principles to provide insight into the physics of black holes and modern cosmology.

Note: ASTR 103, but not ASTR 102, is listed as a prerequisite because this course would be mainly based on the material in ASTR 103 (stars). Although the expectation is that most students would have taken both semesters of Introduction to Astronomy, going with the minimum prerequisite is recommended to simplify dealing with unique situations that will inevitably arise.