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# Missouri State University Curricular Proposal Course Change or Deletion

Department Biology

Date January 27, 2015

Check one: This is a change to  an existing COURSE  
 an existing REGULAR (i.e. permanent) SECTION of a variable content course

Present Course Code and Number BIO 235 Course Title Principles of Genetics

Revised Catalog Description (Copy/paste present description from online catalog, strikethrough all deletions, and insert/bold new information.)

**BIO 235 Principles of Genetics**

~~Prerequisite: BIO 121 or BMS 110; and BIO 122 and CHM 116/117 or CHM 160/161 (recommended) or higher; and MTH 135 or higher. An introduction to basic Concepts of classical, molecular and population and Mendelian genetics, genomics, biotechnology and epigenetics, and an inquiry into the basic processes of evolution. Laboratory emphasis is on the chemical characteristics and in vitro manipulation of nucleic acids. Supplemental course fee.~~

**Complete New Catalog Information**

**BIO 235 Genetics**

Prerequisite: BIO 121 or BMS 110, and CHM 116/117 or CHM 160/161 (recommended) or higher; and MTH 135 or higher. Concepts of classical, molecular and population genetics, genomics, biotechnology and epigenetics. Laboratory emphasis is on the chemical characteristics and in vitro manipulation of nucleic acids. Supplemental course fee.

**What is changing? Check all boxes that apply.**

- Course Deletion
- Course Code
- Course Number
- Title
- Prerequisite
- Credit Hours/Contact Hours
- Periodicity
- Description

**Reason for Proposed Change or Deletion**

*Title:* The comprehensive and integrative nature of BIO 235 is much better described by the title "Genetics" than by the original title.

*Description:* Since the original description of the course was written, the science of genetics has made major advances, and it has become molecular and computational in nature. The field has also spawned several new areas of science (such as genomics and epigenetics) which are increasingly taking center stage in modern biology. As it is taught now, the course incorporates these new areas of study, plus the laboratory section heavily focuses on molecular genetics and recombinant DNA technology. The proposed description better communicates these new aspects of genetics.

*Prerequisite:* New advances in genetics are overwhelmingly molecular and chemistry-based, therefore, require an understanding of basic chemical principles. Students who have not yet taken General Chemistry I struggle with a number of genetic concepts in both lecture and lab. Requiring CHM 160/161 (preferably) or CHM 116/117 will help students better understand the BIO 235 material and benefit more from the course.

**How Did You Determine the Need For This Change or Deletion?**

*Title and Description:* Our experience is that a number of students are caught off guard by the breadth of the material and hence the difficulty level of BIO 235. The original title and terse description seem to reinforce student expectations for an "only 200-level introductory course". The proposed new title and more precise description will better convey the comprehensive nature of the course.

*Prerequisite:* Our experience is that students who have already had CHM 160/161 tend to do well in BIO 235 and are enthusiastic about the material they learn in the course, particularly in the laboratory section. Students who have not yet taken CHM 160/161, on the other hand, often find genetics challenging.

Check if this is a non-substantive change. Distribution for non-substantive changes of 100- through 500-level courses: two originally-signed copies to Faculty Senate; 600- through 900-level courses: three originally-signed copies to Graduate Council. Graduate Council will give two copies to Faculty Senate after approval.

**Substantive Change:** Department routes according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty: Forward three originally signed forms to one of the following (please check all that apply and send to first council/committee marked). If proposal needs to go through more than one council/committee, forward one additional form for each additional council/committee marked. See Senate Action 11-93/94 for definitions of substantive/non-substantive changes.

- College Council** (All substantive course changes numbered 100-599 must go through College Council first. After approval, College Council will forward appropriate number of copies to the next committee/council or directly to the Faculty Senate if no further committee approval is needed. The last level of committee/council will forward two originally signed copies to the Faculty Senate.)
- Professional Education Committee** (Considers all substantive course changes for Professional Education courses and Teaching Methods courses.)
- Committee on General Education and Intercollegiate Programs** (Considers all substantive course changes for General Education and Intercollegiate Program proposals.)
- Graduate Council** (Considers all 600-900 level course changes.)

Signature A Mathur  
Department Head

Date 1-23-15

(Routing on Reverse Side)

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# Missouri State University Curricular Proposal Course Change or Deletion

Department Biology

Date 1/28/2015

Check one: This is a change to  an existing COURSE  
 an existing REGULAR (i.e. permanent) SECTION of a variable content course

Present Course Code and Number BIO485 Course Title Marine Conservation

Revised Catalog Description (Copy/paste present description from online catalog, strikethrough all deletions, and insert/bold new information.)

BIO 485 Marine Conservation

Recommended Prerequisite: BIO 101 and 111, or BIO 122. An overview of current issues related to the conservation and management of marine organisms, with emphasis on marine species and habitats exploited or endangered by human actions. May be taught concurrently with BIO 685. Cannot receive credit for both BIO 485 and 685. Public Affairs Capstone Experience course.

Credit hours: 1-3 Lecture contact hours: 1-3 Lab contact hours: 0  
Typically offered: ~~Upon demand~~ Fall, Summer

### Complete New Catalog Information

BIO 485 Marine Conservation

Recommended Prerequisite: BIO 101 and 111, or BIO 122. An overview of current issues related to the conservation and management of marine organisms, with emphasis on marine species and habitats exploited or endangered by human actions. May be taught concurrently with BIO 685. Cannot receive credit for both BIO 485 and 685. Public Affairs Capstone Experience course.

Credit hours: 1-3 Lecture contact hours: 1-3 Lab contact hours: 0  
Typically offered: Fall, Summer

### What is changing? Check all boxes that apply.

- Course Deletion
- Course Code
- Course Number
- Title
- Prerequisite
- Credit Hours/Contact Hours
- Periodicity
- Description

### Reason for Proposed Change or Deletion

To bring catalog description in line with the current course periodicity and add missing information on contact hours.

### How Did You Determine the Need For This Change or Deletion?

Course has been taught with this periodicity for past several years.

Check if this is a **non-substantive** change. Distribution for non-substantive changes of 100- through 500-level courses: two originally-signed copies to Faculty Senate; 600- through 900-level courses: three originally-signed copies to Graduate Council. Graduate Council will give two copies to Faculty Senate after approval.

**Substantive Change:** Department routes according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty. Forward three originally signed forms to one of the following (please check all that apply and send to first council/committee marked). If proposal needs to go through more than one council/committee, forward one additional form for each additional council/committee marked. See Senate Action 11-93/94 for definitions of substantive/non-substantive changes.

College Council

(All substantive course changes numbered 100-599 must go through College Council first. After approval, College Council will forward appropriate number of copies to the next committee/council or directly to the Faculty Senate if no further committee approval is needed. The last level of committee/council will forward two originally signed copies to the Faculty Senate.)

Professional Education Committee

(Considers all substantive course changes for Professional Education courses and Teaching Methods courses.)

Committee on General Education and Intercollegiate Programs

(Considers all substantive course changes for General Education and Intercollegiate Program proposals.)

Graduate Council

(Considers all 600-900 level course changes.)

Signature

Alicia Mathis  
Department Head

Date

1-29-15

(Routing on Reverse Side)

FS Program Change - 10/8/2013

# Missouri State University Curricular Proposal Course Change or Deletion

Department Biology

Date 1/28/2015

Check one: This is a change to  an existing COURSE  
 an existing REGULAR (i.e. permanent) SECTION of a variable content course

Present Course Code and Number BIO 685 Course Title Marine Conservation

Revised Catalog Description (Copy/paste present description from online catalog, strikethrough all deletions, and insert/bold new information.)

BIO 685 Marine Conservation

An overview of current issues related to the conservation and management of marine organisms, with emphasis on marine species and habitats exploited or endangered by human actions. BIO 485 may be taught concurrently with BIO 685. Cannot receive credit for both BIO 685 and 485.

Credit hours: 1-3 Lecture contact hours: 1-3 Lab contact hours: 0  
Typically offered: ~~Upon demand~~ Fall, Summer

### Complete New Catalog Information

BIO 685 Marine Conservation

An overview of current issues related to the conservation and management of marine organisms, with emphasis on marine species and habitats exploited or endangered by human actions. BIO 485 may be taught concurrently with BIO 685. Cannot receive credit for both BIO 685 and 485.

Credit hours: 1-3 Lecture contact hours: 1-3 Lab contact hours: 0  
Typically offered: Fall, Summer

### What is changing? Check all boxes that apply.

- Course Deletion
- Course Code
- Course Number
- Title
- Prerequisite
- Credit Hours/Contact Hours
- Periodicity
- Description

### Reason for Proposed Change or Deletion

To bring catalog description in line with the current course periodicity and add missing information on contact hours.

### How Did You Determine the Need For This Change or Deletion?

Course has been taught with this periodicity for past several years.

Check if this is a **non-substantive** change. Distribution for non-substantive changes of 100- through 500-level courses: two originally-signed copies to Faculty Senate; 600- through 900-level courses: three originally-signed copies to Graduate Council. Graduate Council will give two copies to Faculty Senate after approval.

**Substantive Change:** Department routes according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty. Forward three originally signed forms to one of the following (please check all that apply and send to first council/committee marked). If proposal needs to go through more than one council/committee, forward one additional form for each additional council/committee marked. See Senate Action 11-93/94 for definitions of substantive/non-substantive changes.

College Council

(All substantive course changes numbered 100-599 must go through College Council first. After approval, College Council will forward appropriate number of copies to the next committee/council or directly to the Faculty Senate if no further committee approval is needed. The last level of committee/council will forward two originally signed copies to the Faculty Senate.)

Professional Education Committee

(Considers all substantive course changes for Professional Education courses and Teaching Methods courses.)

Committee on General Education and Intercollegiate Programs

(Considers all substantive course changes for General Education and Intercollegiate Program proposals.)

Graduate Council

(Considers all 600-900 level course changes.)

Signature

*Alissa Mathis*  
Department Head

Date

1-29-15

(Routing on Reverse Side)

Missouri State University  
Curricular Proposal Course Change or Deletion

Department Geography, Geology & Planning Date November 12, 2014

Check one: This is a change to  an existing COURSE  
 an existing REGULAR (i.e. permanent) SECTION of a variable content course

Present Course Code and Number PLN 576 Course Title Site Planning Studio

Revised Catalog Description (Copy/paste present description from online catalog, strikethrough all deletions, and insert/bold new information.)

PLN 576 Site Planning and Design Studio  
Prerequisite: ~~PLN 271 371 an and~~ PLN 372. ~~Lecture studio focusing~~ **Focuses** on the principles and processes of urban design and site specific design requirements **planning approaches in evaluating, planning, and designing sites within the context of natural and cultural systems.** ~~Students will design site plans for specific uses such as subdivisions, shopping centers and parks for public presentation.~~ **Provides a foundation for conducting any type of site planning project. A specific site in the region is studied and plans are developed for present and future use.** May be taught concurrently with PLN 676. Cannot receive credit for both PLN 676 and PLN 576. Credit hours: 4 Lecture contact hours: ~~2~~ **3** Lab contact hours: ~~4~~ **2** Typically offered: Fall

Complete New Catalog Information

PLN 576 Site Planning and Design Studio  
Prerequisite: ~~PLN 371 and~~ PLN 372. Focuses on the principles of site planning approaches in evaluating, planning, and designing sites within the context of natural and cultural systems. Provides a foundation for conducting any type of site planning project. A specific site in the region is studied and plans are developed for present and future use. May be taught concurrently with PLN 676. Cannot receive credit for both PLN 676 and PLN 576. Credit hours: 4 Lecture contact hours: 3 Lab contact hours: 2 Typically offered: Fall

What is changing? Check all boxes that apply.

- Course Deletion     Course Code     Course Number     Title     Prerequisite
- Credit Hours/Contact Hours     Periodicity     Description

Reason for Proposed Change or Deletion

To bring catalog description in line with current course content.

How Did You Determine the Need For This Change or Deletion?

This course has evolved over the past several years, in response to feedback both from alumni and accreditation site-visit teams.

Check if this is a non-substantive change. Distribution for non-substantive changes of 100- through 500-level courses: two originally-signed copies to Faculty Senate; 600- through 900-level courses: three originally-signed copies to Graduate Council. Graduate Council will give two copies to Faculty Senate after approval.

Substantive Change: Department routes according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty. Forward three originally signed forms to one of the following (please check all that apply and send to first council/committee marked). If proposal needs to go through more than one council/committee, forward one additional form for each additional council/committee marked. See Senate Action 11-93/94 for definitions of substantive/non-substantive changes.

- College Council (All substantive course changes numbered 100-599 must go through College Council first. After approval, College Council will forward appropriate number of copies to the next committee/council or directly to the Faculty Senate if no further committee approval is needed. The last level of committee/council will forward two originally signed copies to the Faculty Senate.)
- Professional Education Committee (Considers all substantive course changes for Professional Education courses and Teaching Methods courses.)
- Committee on General Education and Intercollegiate Programs (Considers all substantive course changes for General Education and Intercollegiate Program proposals.)
- Graduate Council (Considers all 600-900 level course changes.)

Signature Thomas H. Offgale  
Department Head

Date 1/28/2015

(Routing on Reverse Side)

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# Missouri State University Curricular Proposal Program Change or Deletion

Department PAMS Date January 16, 2015

Title of Program Affected Astronomy Minor

Type of Program: Major  Comprehensive Major  Option  Minor  Certificate   
Certification  Academic Rules  Other

### Revised Catalog Description

Astronomy

Bachelor of Arts

Bachelor of Science

A. **AST 113 (3)** or 114(4) or 115(4); 311(3)

B. Complete two of the following: AST 313(3), 315(3), 317(3)

C. Complete additional physics or astronomy courses to bring total to 18 hours with no more than 10 hours of courses numbered below 300. Recommended electives: AST 110(1) if **AST 113** or 114 was taken; PHY 123(4), 124(4), 386(1), 486(1)

### Complete New Catalog Description

Astronomy

Bachelor of Arts

Bachelor of Science

A. AST 113(3) or 114(4) or 115(4); 311(3)

B. Complete two of the following: AST 313(3), 315(3), 317(3)

C. Complete additional physics or astronomy courses to bring total to 18 hours with no more than 10 hours of courses numbered below 300. Recommended electives: AST 110(1) if AST 113 or 114 was taken; PHY 123(4), 124(4), 386(1), 486(1)

Total Hours 18

### What is changing? Check all boxes that apply.

- Title change  From option to program (major)  Other
- Course changes of under 18 hours  From program (major) to option
- Course changes of 18 hours or more  Program or option deletion

### Reason for Proposed Change

Adding the 3 credit general education course to the program.

**DEPARTMENT: Route according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty Senate. Forward three typed, originally signed forms to one of the following (please check all that apply and send to first council/committee marked). If the program needs to go through more than one committee/council, forward one additional form for each additional council/ committee marked.**

**College Council** (Send all undergraduate program changes through College Council as first step before forwarding either to PEC, CGEIP, or directly to Faculty Senate)

**Professional Education Committee** (Considers all program changes affecting BS and MS in Education and Educational Specialist degrees)

**Committee on General Education and Intercollegiate Programs** (Considers all general education and multi-college program changes)

**Graduate Council** (Considers all graduate-level program changes)

Signature   
Department Head

Date 1-23-15

(Routing on Reverse Side)

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Missouri State University  
CURRICULAR PROPOSAL

NEW COURSE (or new REGULAR SECTION of an existing variable content course)

Department Physics, Astronomy, and Materials Science

Date January 22, 2015

Check one:  New COURSE  New REGULAR (i.e. permanent) SECTION of an existing variable content course. If a new regular section of an existing variable topics course, to what existing course is it to be attached? \_\_\_\_\_

Course Code AST Course Number 112 Course Title Life in the Universe

PROPOSED CATALOG DESCRIPTION

General Education Course. (Breadth of Knowledge—Natural World—Life Sciences). 3(3-0).

An exploration of how life came to be on the planet Earth, prospects for detecting it on other worlds and what that detection, or non-detection, means to humanity. Topics include the origin of elements in the Universe and how they form the building blocks of life, how conditions favorable for life evolve on planets, how life evolves, biodiversity, recent discoveries of exoplanets, and possible effects on society.

PURPOSE OF COURSE

With thousands of planets discovered around other stars, the potential of detecting alien life (intelligent or not), and the consequences of those detections or non-detections, is something this generation will have to address. The big question, "Are we alone in the Universe?" will be answered within our students' lifetime, and most likely within the next few decades. This course will inform and educate our students about this timely topic to better prepare them for the amazing discoveries ahead. This course allows students to partially fulfill the Breadth of Knowledge-Natural World requirements in the General Education Program. Also see the attached pages.

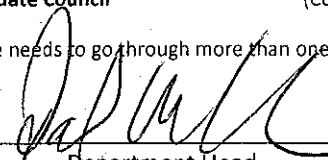
RELATIONSHIP TO OTHER DEPARTMENTS

The undergraduate course catalog lists an intercession course titled Astrobiology (BMS455) which has not been offered in many years. This course is similar, but more in depth and leans more towards the astronomical impacts on evolution, aliens, and the human experience. Students are now required to take a course under the Life Sciences division of the Breadth of Knowledge-Natural World component of General Education. AST 112 Life in the Universe will be an additional offering in this component with material that is interdisciplinary, exciting, dynamic, and which addresses some of the oldest questions posed by human beings.

DEPARTMENT: Route according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty. Attach New Course Resource Information form (FS 00a/05) and forward three typed, originally signed forms to one of the following (please check all that apply and send to first council/committee marked). If the course needs to go through more than one council/committee forward one additional form for each additional council/committee marked.

- College Council (All new course proposals numbered 100-599 must go through College Council first. After approval, College Council will forward appropriate number of copies to the next committee/ council or directly to the Faculty Senate if no further committee approval is needed.)
- Professional Education Committee (Considers all new courses affecting BS and MS in Education and Educational Specialist degrees)
- Committee on General Education and Intercollegiate Programs (Considers all general education and multi-college new course proposals)
- Graduate Council (Considers all 600-, 700-, and 800-level new courses)

If the course needs to go through more than one council/committee, forward one additional form for each additional council/committee marked.

Signature  Department Head

Date 1-27-15

(Routing on Reverse Side)

FS New Course - 4/10/2014

5

**NEW COURSE RESOURCE INFORMATION**Department Physics, Astronomy, and Materials ScienceDate January 20, 2015Course Number and Title AST 112 Life in the UniverseAnticipated Average Enrollment 100Maximum Enrollment Limit 130Faculty Load Assignment 3 Equated Hours1 Is another course being deleted? No If so, give course number and title.

2 What will this course require in the way of:

Additional library holdings? None.Additional computer resources? None. Access to current computer labs is sufficient.Additional or remodeled facilities? None.Additional equipment or supplies? None, this is not a lab course.Additional travel funds? None.Additional faculty--general vs specialized? None.Other additional expenses? None.

3 If additional faculty are not required, how will faculty be made available to teach this course?

The Physics, Astronomy, and Materials Science Department is adjusting its astronomy course offerings in response to the revised General Education Program. Condensing the current offerings allows for the inclusion of this new course.

List names of current faculty qualified to teach this course:

Becky Baker, Bob Patterson (taught a shorter version as a special course), Peter Plavchan (taught a version at UCLA), and Mike Reed.

4 What is the anticipated source of students for this course? (If from within the department, will students be taking this course in addition to or in place of other courses? If from outside the department, which courses in other departments would most likely be affected?)

This is a General Education course. The source of students is the same as for current introductory astronomy courses, namely, the entire student body.

5 Other comments:

## AST 112 Life in the Universe - Sample Syllabus

**Purpose:** This is a general education life science course covering the evolution of life in the Universe and prospects and impacts of extraterrestrial life. This course meets the Life Science General Goal: Students will understand basic concepts of living things, the nature of scientific knowledge, and relevance of biological knowledge to human affairs. The Specific Learning Outcomes are 1) Understand living systems by describing their nature, organization and evolution. 2) Understand and use the processes by which scientific knowledge of living things is generated. 3) Develop knowledge of living things through hypothesis testing and gain the ability to draw defensible conclusions regarding living things. 4) Make logical connections between key concepts in the life sciences and describe the interaction between human lives and other living things. 5) Understanding the human species as a biological organism. And 6) Understand the ways the environment impacts humanity and how human actions affect the environment. Other learning outcomes for this course are: 1) To understand how the Universe evolved to become hospitable for life; 2) To understand how Earth-based life developed, 3) evolved, and 4) was affected by astronomical events; 5) To understand the relationships between humans, other life, and their environments, including 6) terraforming; 7) To understand discoveries within our solar system and of exoplanets in relation to where life could exist; and 8) To examine the possible effects on society and humanity with acquired knowledge of whether or not alien life exists. The learning outcomes for this course will be evaluated using tests, focus group discussions, quizzes, homework, a questionnaire, and group projects.

**Course design:** The course will use the Drake Equation as a focus and will include the following sections:

- 1) History of the Universe with a focus on chemical production and energy which leads to a Universe where humans and other aliens could exist.
- 2) History of life on Earth as our only example of life within the Universe.
- 3) The biology and chemistry of life- conditions for life, including extremophiles.
- 4) Prospects for diversity of life.
- 5) Current exoplanet research in relation to where life could exist and how to find out whether there is alien life.
- 6) Impacts on society whether there is or isn't alien life.

**Student Success:** The mission of Missouri State University is to develop educated persons. In this class, we will use the following instructional methods which support student learning and success: 1) small (focus) group discussions; 2) peer instruction; 3) clickers; and 4) group projects.

**Materials:** The texts for this course are *Life in the Universe* by Bennett and Shostak and *How Life Began: Evolution's Three Geneses* by Meinesz. These are the only texts you will need for this course. However, this is a very dynamic and evolving area of science and so (some) lecture notes, useful links, and other material will be posted on the web.



### AST 112 Life in the Universe - Sample Schedule

<i>Week</i>	<i>Dates</i>	<i>Topics</i>	<i>Chapters</i>
1-3	August (M, W, F)	<ul style="list-style-type: none"><li>• Course overview, the scientific search for life in the universe.</li><li>• Ancient astronomy, basic astronomy.</li><li>• Formation of the solar system</li></ul>	1 - 3
4-5	September (M, W, F)	<ul style="list-style-type: none"><li>• Cosmology, the origins of the Universe</li><li>• Matter, Energy &amp; Light</li><li>• The Habitability of Earth</li></ul>	4 - 5
6-8	September (M, W, F)	<ul style="list-style-type: none"><li>• Appearance of life on Earth &amp; Evolution</li><li>• Searching for Life in the Solar System &amp; in particular Mars</li></ul>	6 - 8
9-11	October (M, W, F)	<ul style="list-style-type: none"><li>• <u>Midterm Exam (Chapters 1-8)</u></li><li>• Search for life in the solar system: Jupiter and beyond</li><li>• The Life Cycle, Classification of Stars, Nature of Habitability and the search for habitable worlds around other stars</li></ul>	9
12-14	November (M, W, F)	<ul style="list-style-type: none"><li>• The Habitable Zone and Earth's Fate</li><li>• Climate Change and Global Warming</li><li>• Exoplanets</li></ul>	10-11
15-16	December (M, W, F)	<ul style="list-style-type: none"><li>• Search for Intelligent Life (SETI)</li><li>• Interstellar travel and Fermi Paradox</li><li>• <u>Final Exam (in class, cumulative)</u></li></ul>	12,13

# AST 112 Life in the Universe - Sample Outline

## Chapter 1

- Extraterrestrial life:** life beyond Earth
- Extrasolar planets:** planets orbiting stars other than our sun
- Habitable worlds:** worlds that contain the basic necessities for life (Organic molecules for life. Must look for simple organisms)
- SETI:** search for extraterrestrial intelligence

## Chapter 2

- Greeks on Extraterrestrial life
- Atomists: believed Earth and the heavens made from infinite number of indivisible atoms of each of the four elements
- Belief in extraterrestrial life
- Natural to assume that the same processes that created our world could also have created others
- Aristotelians: the four elements were confined to the realm of Earth, while heavens were made of distinct element ether World must be unique, so no other worlds exist
- A scientific model must make testable predictions about natural phenomena that would force us to revise or abandon the model if the predictions do not agree with observations.
- Paradigm
- Scientific Theory

## Chapter 3

- Astronomical Definitions)
  - Star, planet, extrasolar planet, habitable planet, moon or satellite, asteroid, comet, solar system, star system, galaxy, universe or cosmos
- Expanding Universe
  - Evidence comes from the overall chemical composition of the universe – calculations that run the expansion backwards led scientists to predict that the universe was about ¾ hydrogen and ¼ helium, which observations closely match.
- Star Stuff
  - When we say that Earth and life are made from “star stuff”, what we really mean is that the elements that make up the Earth and life were made from the fusion of helium and hydrogen inside stars larger than our sun.
- Accretion and terrestrial planet formation
- Jovian Planet Formation

## Chapter 4

- Geology: the study of earth, or any world with a solid surface
- Rock analysis
  - Mineralogical analysis
  - Chemical analysis
  - Isotopic analysis
  - Radiometric dating
- Most reliable way to determine the age of a rock, fossil, or other solid object
- Radioactive decay always occurs at a specific and measurable rate that is different for every radioactive isotope.

Idea is to determine the age of a rock from the ratio of parent and daughter atoms within it, which depends only on the decay rate and the length of time over which the decay has been occurring.

Geological time scale

**4 Eons**

Hadean - oldest!

Archean- 2.5 to 3.85 bya

Proterozoic- 540 mya to 2.5 bya

Phanerozoic- Present to 540 mya

**3 eras**

Paleozoic (old life)

Mesozoic (middle life)

Cenozoic (recent life)

**Eras divided into periods**

Age of Earth

Oldest intact earth rocks date to about 4 bya

Radiometric dating shows that tiny mineral grains of zirconium silicate (zircons) date to 4.4 bya

Rocks on moon date to 4.4 bya

Maximum age set by dating formation of solar system as a whole via meteorites that are 4.57 bya

Key geological definitions

The Hadean Earth and the Dawn of Life

Atmosphere

Possible to inhabit earth after 100 myrs. Many modern day microbes survive in absence of oxygen.

However, lots of volcanic eruptions.

Possible Sterilizing impacts

Impact of object 10-20 km thought to have caused the extinction of dinosaurs 65 mya

Asteroid of 350-400 km would vaporize the oceans and raise global surface temperature to 2000 deg C

No way to know if anything this big happened during hadean period

Greenhouse effect makes earth habitable

Global average temperature: average temperature of the entire planet

Green house effect

Regulating Earth's temperature

The Carbon dioxide cycle

Chapter 5

Properties of Life

**Order:** exhibit some sort of order in the molecules or the arrangement of the atoms

**Reproduction:** reproduce or are products of reproduction

**Growth and development**

**Energy utilization**

**Response to the environment**

**Evolutionary adaptation**

**Species:** groups of organisms that are genetically distinct from other groups

**Genus:** the *generic* category to which an organism belongs, which will be *specified* by the species

Mechanisms for Evolution

Fact 1: overproduction and competition for survival

Fact 2: individual variation.

Fact 3: the inescapable conclusion: unequal reproductive success

"Natural selection"

Cells

Cells: microscopic units in which the living matter inside is separated from the outside world by a barrier called a membrane

All pass on their hereditary information with DNA

Earth life is carbon based

Life on earth made of 20 different elements

Oxygen, carbon, hydrogen, and nitrogen make up 96% of mass of typical living cells

Silicon based life – 3 strikes!

Bonds formed by silicon significantly weaker than carbon bonds. i.e. more fragile, making complex molecules too fragile to form the structural components of living cells

Silicon does not normally form double bonds, which carbon does. This limits the variety of molecular structures

Carbon can be mobile in the environment in the form of gaseous carbon dioxide, but silicon dioxide is a solid

Molecular components of cells

Carbohydrates: provide energy to cells, cellular structure

Lipids: store energy for cells. Can spontaneously form membranes in water, trapping other organic molecules inside the membrane – important for early earth

Proteins: key evidence of common ancestor of life!!

Some serve as structural elements, enzymes are crucial to all important biochemical reactions (including copying of DNA), catalyst facilitates a chemical reaction or accelerates it

Built with large chains of amino acids – this is important evidence that all life on earth shares a common ancestor

Nucleic acids: DNA, RNA (carries instructions to DNA)

3 Domains of Life on Earth

Bacteria

Archaea

Eukarya

4 Metabolic Classifications

Photoautotrophs: get energy from plants and carbon from carbon dioxide in the environment plants

Chemoautotrophs: get energy from chemical reactions and carbon from environmental carbon dioxide Need neither sun nor food to survive. Archaea in hot springs are an example.

Photoheterotrophs: get energy from sun and carbon from consuming other organisms or their remains Much rarer. Found in lakes, rivers, hot springs, and some aquatic environments with very high salt concentrations

Chemoheterotrophs: get energy from chemical reactions and carbon from consuming other organisms Water and the Metabolism

Metabolism requires that organic chemicals be readily available for reactions, and liquid water allows organic chemicals to float within the cell

Metabolism requires a means for transporting chemicals to and within cells

Water plays role in many of the metabolic reactions within cells, i.e. necessary for the reactions that store and release energy in ATP= adenosine triphosphate

**ATP is used to store and release energy – every living cell uses it!**

What kinds of conditions can life survive?

Extremophiles: organisms that survive in extreme environments

Endoliths (within rocks) special interest for Mars. Live within rocks, chemoautotrophs

Thermophiles: organisms that survive in extremely hot water

Many from Archaea domain.

A lot of hyperthermophiles are anaerobic (live without oxygen)

Psychrophiles: cold-loving organisms

### Chapter 6

Stromatolites: rocks that are characterized by a distinctive, layered structure.

Photosynthesize and those below use the waste products of the photosynthesized microbes.

Evidence that they date back as far as 3.5 bya

Microfossils

Difficult to find because old rocks are often destroyed with time, altered by geological processes

3.5-3.2 bya: fossilized cells, up to debate.

2.7-3 bya: particular molecules that almost certainly indicate biological origin

Isotopic Evidence

The Miller-Urey Experiment

Other Sources of Organic Materials

RNA World

Possibility of Migration

### Chapter 7

Water's role on Earth

Potential liquids for life

Ammonia, methane, and ethane remain liquid within reasonable temperatures

#### **Advantages of water**

Environmental requirements for habitability

Must have a source of molecules from which to build living cells

Must have a source of energy to fuel metabolism

Must have a liquid medium – most likely liquid water – for transporting the molecules of life

### Chapter 8

Mars invading popular culture

Conditions on Mars

Temperature well below freezing, atmospheric pressure of 1% of Earth's, 40% of Earth's gravity, days are 40 minutes longer than on earth

Lack of surface liquid water

Geological History

Evidence of water on Mars

Channels almost certainly carved by running water 2-3 bya

Must have had much warmer and thicker atmosphere at one point

Martian water today

Climate

How Mars changed

Habitability

Has elements for life: energy for life (sunlight), chemical energy (underground volcanoes), just needs liquid water

Life on Mars – 3 Viking experiments

However, no measurable level of organic molecules in the Martian soil at all.

Methane detected

Comes from either comet impacts, volcanic activity, or life

Meteorites

Chapter 9

Jovian Moons

Jupiter: Io, Ganymede, Callisto

Europa

Evidence for an ocean

Life on Europa?

Source of elements to build living organisms: rock/water combo probably has all elements needed

Source of energy for growth and metabolism: unknown

If volcanism in deep water vents, then possible. However, on earth, most of energy still filters down from life above.

Total energy available is less than available on earth

Liquid medium for transporting molecules of life?

Saturn

Titan

Atmosphere

Possibility of life

Strong evidence of liquid hydrocarbons, but since methane and ethane are colder than liquid water, chemical reaction rates would be slower, so outlook for biology is bleak.

**Synchronous rotation** of the moons

Tidal Heating

Chemical energy

Need disequilibrium to initiate a chemical reaction

Reduction: process of accepting electrons

Oxidation: process of losing electrons

Electron transport chains: chains of redox reactions used for photosynthesis and other life processes

Amino Acids

Building blocks from proteins

Molecules containing an amine group, a carboxylic acid group and a side chain that varies between different amino acids.

These molecules contain the key elements of carbon, hydrogen, oxygen, and nitrogen.

Handedness

In nature, you see both right and left handed amino acids, but most amino acids in life are left handed

Chapter 10

Habitable zone

Range of distances from a star at which a planet could potentially have surface temperatures that would allow for abundant liquid water

3 factors .

Life outside habitable zone?

Venus

Runaway Greenhouse effect

Global warming

Increasing CO2

Evidence from tree rings and ice cores

Consequences of global warming

Chapter 11

Star's "Life Cycle"

Types of Stars

Multi-star systems

Binary star systems

Detecting planets

Directly

Indirectly

Precise measurements of stellar properties (position, brightness, or spectra) may indirectly reveal the effects of orbiting planets

Gravitational Tugs

Astrometric Technique

Doppler Technique

Transits

Gravitational Lensing

Hot Jupiters

Most of the discovered planets are around size of Jupiter or Saturn (can't detect smaller planets as well yet) and most either have close orbits to the star or highly elliptical orbits

Formation

Planets likely formed in outer regions of their solar systems (Jovian traits), but migrated when waves in the nebula caused these young planets to spiral slowly toward their star.

Habitability

Unlikely these would be habitable, but maybe moons would be

Theoretical work suggests that the migration of hot Jupiters could affect inner solar system seriously, i.e. swallow terrestrial worlds or fling less massive planets inward toward its star or outward to interstellar space

Impact rates and Jupiter

Many trillions of comets orbit the sun (Oort Cloud) at distances beyond Pluto

If Jupiter did not exist, the comets might have remained in the part of the solar system where they could pose a danger to Earth.

Climate stability

Plate tectonics important for climate stability due to its role in CO2 cycle

Earth's tilt is fairly static due to the gravitational tugs from Moon. If there were no moon, Earth's rotation would be greater affected by other planets, causing large swings in tilt.

Chapter 12

Drake Equation

Equation that lays out the factors that are important in determining the number of transmitting civilizations

Does not give us an actual number because we don't know that values of all variables

$$N_{civilizations} = N_{HP} \times f_{life} \times f_{civ} \times f_{now}$$

$N_{HP}$  = habitable planets,  $f_{life}$  = fraction of HP that have life,  $f_{civ}$  = fraction of life with civilization capable of interstellar communication,  $f_{now}$  = fraction of these that have civ now capable of this

Measuring Intelligence

Encephalization Quotient (EQ)

Plot of brain mass vs. body mass, where EQ=1 means typical allotment of mental ability for creatures of their size

Dolphins = 5, chimps = 2.5, humans = 7

EQs for dolphins and whales improved drastically around 35 mya when developed eco-location

An elevated social position for dolphins and primates often allows you to have 1<sup>st</sup> choice in mates, so clever, high-ranking individuals will tend to produce clever, high-ranking offspring.

SETI

Send frequency of 1420 MHz b/c it is the frequency at which neutral hydrogen gas produces natural radio static

Categories of signals

Signals used for local communication on the world where intelligent beings live

Signals used for communication b/w a civilization's home world and some other site, such as a colony or spacecraft on another world

International signal beacons, purposely designed to get the attention of other societies

Chapter 13

Messages abroad

Because spacecraft themselves should survive unscathed for millions of years in the near-vacuum of interstellar space, we have included messages in case any extraterrestrial beings someday find them

Escape velocity

11 km/s to overcome Earth's gravity

Limitations of chemical rockets

Requires a mass ratio (mass of fully fueled rocket to empty rocket) of 39 to reach escape velocity

Spacecraft for interstellar flight

Nuclear fission, Ion engine, Solar sails, Ramjets and Relativity

Fermi Paradox

The idea that neither we nor our planet is in any way special suggests that someone should have colonized the galaxy by now.

The idea of a galactic civilization implies that we should be surrounded by evidence of this civilization – but aside from unconvincing claims of extraterrestrial UFOs, no such evidence exists.

It should have been possible or Earth-like planets to be born at least 5 billion years before our own planet.

Possible solutions

We are alone

Civilizations are common, but no one has colonized the galaxy

Von Neumann machines

General idea of self-replicating machines would allow us to explore much farther and wider than we could by going to other worlds ourselves.

Also, these machines could function after journeys through space that take centuries to millennia.



5

This course is about Life in the Universe wrapped in the context of the Drake Equation. This equation includes factors for 1) how the Universe produced the conditions (chemistry and energy) amenable to life; 2) the conditions which we know are favorable to life (chemicals which are important for life, the developments of proteins to DNA to higher organisms), the prospects for life in other conditions (extremophiles on Earth, silicon-based life, buoyant life on non-Terrestrial planets), the generation and spread of biological materials, and recent results concerning the abundance of planets; 3) evolution of life and astronomical impacts upon evolution; 4) the propensity of life to develop civilizations which emit signals outside of their ecosystem; 5) and the survivability of such civilizations. Beyond the Drake Equation, the class will also consider the impact on current societies whether there is or isn't alien life.

Life Science Goals of understanding basic concepts of living things addressed in #2 & 3; nature of scientific learning in #1; and relevance of biological knowledge to human affairs in #4 & 5.

This course is multidisciplinary in that it draws extensively from astronomy, physics, chemistry, biology and geology. It is timely because only recently could astronomers begin to estimate the numbers and conditions of extrasolar planets, and space exploration has revealed other likely places for life within our own solar system. Most likely, during the lifetimes of our current student population, we will (at least statistically) know whether alien life exists or not!

(6)

**Missouri State University  
Curricular Proposal Course Change or Deletion**

Department PAMS

Date January 16, 2015

Check one: This is a change to X an existing COURSE  
     an existing REGULAR (i.e. permanent) SECTION of a variable content course

Present Course Code and Number AST 113 Course Title Modern Astronomy

**Revised Catalog Description**

AST 113 Modern Astronomy

General Education Course (Focus on Physical Sciences).

An introduction to our present knowledge of the nature of the universe, the galaxies, the stars, and the planets. A description of the natural laws and physical observations which are leading us to an understanding of our place in the cosmos. **May only receive credit for one of AST 113, AST 114, or AST 115.**

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0

Typically offered: Fall, Spring

**Complete New Catalog Information**

AST 113 Modern Astronomy

General Education Course (Focus on Physical Sciences).

An introduction to our present knowledge of the nature of the universe, the galaxies, the stars, and the planets. A description of the natural laws and physical observations which are leading us to an understanding of our place in the cosmos. **May only receive credit for one of AST 113, AST 114, or AST 115.**

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0

Typically offered: Fall, Spring

**What is changing? Check all boxes that apply.**

Course Deletion     Course Code     Course Number     Title     Prerequisite  
 Credit Hours/Contact Hours     Periodicity     Description

**Reason for Proposed Change or Deletion**

To avoid students getting credit for multiple courses which are similar.

**How Did You Determine the Need For This Change or Deletion?**

Currently, students could obtain credit for two similar courses. This change avoids that.

Check if this is a **non-substantive** change. Distribution for non-substantive changes of 100- through 500-level courses: two originally-signed copies to Faculty Senate; 600- through 900-level courses: three originally-signed copies to Graduate Council. Graduate Council will give two copies to Faculty Senate after approval.

**Substantive Change:** Department routes according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty. Forward three originally signed forms to one of the following (please check all that apply and send to first council/committee marked). If proposal needs to go through more than one council/committee, forward one additional form for each additional council/committee marked. See Senate Action 11-93/94 for definitions of substantive/non-substantive changes.

**College Council**

(All substantive course changes numbered 100-599 must go through College Council first. After approval, College Council will forward appropriate number of copies to the next committee/council or directly to the Faculty Senate if no further committee approval is needed. The last level of committee/council will forward two originally signed copies to the Faculty Senate.)

**Professional Education Committee**

(Considers all substantive course changes for Professional Education courses and Teaching Methods courses.)

**Committee on General Education**

(Considers all substantive course changes for General Education and

intercollegiate Program

**and Intercollegiate Programs**

proposals.)

**Graduate Council**

(Considers all 600-900 level course changes.)

Signature [Signature]

Department Head

Date 1-23-15

7

# Missouri State University Curricular Proposal Course Change or Deletion

Department PAMS

Date January 16, 2015

Check one: This is a change to  an existing COURSE  
 an existing REGULAR (i.e. permanent) SECTION of a variable content course

Present Course Code and Number AST 114 Course Title Survey of Astronomy

Revised Catalog Description (Copy/paste present description from online catalog, strikethrough all deletions, and insert/bold new information.)

AST 114 Survey of Astronomy  
General Education Course (Focus on Physical Sciences).  
Historical and descriptive aspects of astronomy; topics of  
current interest related to space science. ~~Cannot receive credit  
for both AST 114 and 115. May only receive credit  
for one of AST 113, AST 114, or AST 115.~~  
Credit hours: 4 Lecture contact hours: 4 Lab contact hours: 0  
Typically offered: Fall, Spring

### Complete New Catalog Information

AST 114 Survey of Astronomy  
General Education Course (Focus on Physical Sciences).  
Historical and descriptive aspects of astronomy; topics of  
current interest related to space science. May only receive credit  
for one of AST 113, AST 114, or AST 115.  
Credit hours: 4 Lecture contact hours: 4 Lab contact hours: 0  
Typically offered: Fall, Spring

### What is changing? Check all boxes that apply.

- Course Deletion    Course Code    Course Number    Title    Prerequisite  
 Credit Hours/Contact Hours    Periodicity    Description

### Reason for Proposed Change or Deletion

To avoid students getting credit for multiple courses which are similar.

### How Did You Determine the Need For This Change or Deletion?

Currently, students could obtain credit for two similar courses. This change avoids that.

Check if this is a **non-substantive** change. Distribution for non-substantive changes of 100- through 500-level courses: two originally-signed copies to Faculty Senate; 600- through 900-level courses: three originally-signed copies to Graduate Council. Graduate Council will give two copies to Faculty Senate after approval.

**Substantive Change:** Department routes according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty. Forward three originally signed forms to one of the following (please check all that apply and send to first council/committee marked). If proposal needs to go through more than one council/committee, forward one additional form for each additional council/committee marked. See Senate Action 11-93/94 for definitions of substantive/non-substantive changes.

**College Council**

(All substantive course changes numbered 100-599 must go through College Council first. After approval, College Council will forward appropriate number of copies to the next committee/council or directly to the Faculty Senate if no further committee approval is needed. The last level of committee/council will forward two originally signed copies to the Faculty Senate.)

**Professional Education Committee**

(Considers all substantive course changes for Professional Education courses and Teaching Methods courses.)

**Committee on General Education**

Intercollegiate Program

and Intercollegiate Programs

(Considers all substantive course changes for General Education and proposals.)

**Graduate Council**

(Considers all 600-900 level course changes.)

Signature [Signature]

Department Head

Date 1-23-15

(8)

**Missouri State University  
Curricular Proposal Course Change or Deletion**

Department                      PAMS                      Date            January 16, 2015           

Check one: This is a change to   X   an existing COURSE  
           an existing REGULAR (i.e. permanent) SECTION of a variable content course

Present Course Code and Number   AST 115   Course Title   Basic Astronomy  

**Revised Catalog Description**

AST 115 Basic Astronomy  
General Education Course (Focus on Physical Sciences).  
Historical and descriptive aspects of astronomy; topics of current interest related to space science. Laboratory consists of observations with telescopes and of experiments pertinent to the field. ~~Cannot receive credit for both AST 114 and 115.~~  
**May only receive credit for one of AST 113, AST 114, or AST 115.**  
Supplemental course fee.  
Credit hours: 4 Lecture contact hours: 3 Lab contact hours: 2  
Typically offered: Fall, Spring

**Complete New Catalog Information**

AST 115 Basic Astronomy  
General Education Course (Focus on Physical Sciences).  
Historical and descriptive aspects of astronomy; topics of current interest related to space science. Laboratory consists of observations with telescopes and of experiments pertinent to the field. ~~Cannot receive credit for both AST 114 and 115.~~ May only receive credit for one of AST 113, AST 114, or AST 115.  
Supplemental course fee.  
Credit hours: 4 Lecture contact hours: 3 Lab contact hours: 2  
Typically offered: Fall, Spring

**What is changing? Check all boxes that apply.**

- Course Deletion     Course Code                       Course Number     Title                       Prerequisite  
 Credit Hours/Contact Hours                       Periodicity                      X Description

**Reason for Proposed Change or Deletion**

To avoid students getting credit for multiple courses which are similar.

**How Did You Determine the Need For This Change or Deletion?**

Currently, students could obtain credit for two similar courses. This change avoids that.

Check if this is a **non-substantive** change. Distribution for non-substantive changes of 100- through 500-level courses: two originally-signed copies to Faculty Senate; 600- through 900-level courses: three originally-signed copies to Graduate Council. Graduate Council will give two copies to Faculty Senate after approval.

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**College Council**

(All substantive course changes numbered 100-599 must go through College Council first. After approval, College Council will forward appropriate number of copies to the next committee/council or directly to the Faculty Senate if no further committee approval is needed. The last level of committee/council will forward two originally signed copies to the Faculty Senate.)

**Professional Education Committee**

(Considers all substantive course changes for Professional Education courses and Teaching Methods courses.)

**Committee on General Education**

(Considers all substantive course changes for General Education and

intercollegiate Program

and Intercollegiate Programs

proposals.)

**Graduate Council**

(Considers all 600-900 level course changes.)

Signature                     

Department Head

Date            1-23-15

Missouri State University  
Curricular Proposal Course Change or Deletion

9

Department PAMS Date January 16, 2015

Check one: This is a change to  an existing COURSE  an existing REGULAR (i.e. permanent) SECTION of a variable content course

Present Course Code and Number AST 313 Course Title The New Solar Systems

Revised Catalog Description

AST 313 The New Solar Systems

Prerequisite: **AST113 or AST 114 or AST 115; MTH 138 or above.**

A modern inquiry of the planets, comets, asteroids, and other members of our solar system and the planets of other stellar systems, based on recent interplanetary explorations and Earth-based observations. ~~Cannot receive credit for both AST 313 and AST 513. May only receive credit for one of AST 313, AST 513, or AST 613.~~

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0

Typically offered: Fall (odd-numbered years)

Complete New Catalog Information

AST 313 The New Solar Systems

Prerequisite: **AST113 or AST 114 or AST 115; MTH 138 or above.**

A modern inquiry of the planets, comets, asteroids, and other members of our solar system and the planets of other stellar systems, based on recent interplanetary explorations and Earth-based observations. May only receive credit for one of AST 313, AST 513, or AST 613.

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0

Typically offered: Fall (odd-numbered years)

What is changing? Check all boxes that apply.

- Course Deletion       Course Code       Course Number       Title       Prerequisite
- Credit Hours/Contact Hours       Periodicity       Description

Reason for Proposed Change or Deletion

Updating to reflect General Education Course AST 113.

How Did You Determine the Need For This Change or Deletion?

Currently, students taking AST 113 would not meet the prerequisites for AST 313, though they should.

Check if this is a **non-substantive** change. Distribution for non-substantive changes of 100- through 500-level courses: two originally-signed copies to Faculty Senate; 500- through 900-level courses: three originally-signed copies to Graduate Council. Graduate Council will give two copies to Faculty Senate after approval.

**Substantive Change:** Department routes according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty. Forward three originally signed forms to one of the following (please check all that apply and send to first council/committee marked). If proposal needs to go through more than one council/committee, forward one additional form for each additional council/committee marked. See Senate Action 11-93/94 for definitions of substantive/non-substantive changes.

College Council

Professional Education Committee

Committee on General Education and Intercollegiate Programs

Graduate Council

Signature [Signature]  
Department Head

Date 1-27-15

(Routing on Reverse Side)

Missouri State University  
Curricular Proposal Course Change or Deletion

10

Department PAMS

Date January 16, 2015

Check one: This is a change to X an existing COURSE      an existing REGULAR (i.e. permanent) SECTION of a variable content course

Present Course Code and Number AST 315 Course Title The Lives and Deaths of Stars

Revised Catalog Description

AST 315 The Lives and Deaths of Stars

Prerequisite: **AST 113** or AST 114 or 115; and MTH 138 or above.

The structure of stars, processes at work in stellar atmospheres, the formation process, and the evolution of stars into white dwarfs, neutron stars, or black holes. ~~Cannot receive credit for both AST 315 and AST 515.~~ **May only receive credit for one of AST 315, AST 515, or AST 615.**

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0

Typically offered: Spring (odd-numbered years)

Complete New Catalog Information

AST 315 The Lives and Deaths of Stars

Prerequisite: **AST 113** or AST 114 or 115; and MTH 138 or above.

The structure of stars, processes at work in stellar atmospheres, the formation process, and the evolution of stars into white dwarfs, neutron stars, or black holes. **May only receive credit for one of AST 315, AST 515, or AST 615.**

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0

Typically offered: Spring (odd-numbered years)

What is changing? Check all boxes that apply.

- Course Deletion     Course Code                       Course Number     Title            X Prerequisite
- Credit Hours/Contact Hours                       Periodicity                      X Description

Reason for Proposed Change or Deletion

Updating to reflect General Education Course AST 113.

How Did You Determine the Need For This Change or Deletion?

Currently, students taking AST 113 would not meet the astronomy prerequisite for AST 315, though they should.

Check if this is a **non-substantive** change. Distribution for non-substantive changes of 100- through 500-level courses: two originally-signed copies to Faculty Senate; 600- through 900-level courses: three originally-signed copies to Graduate Council. Graduate Council will give two copies to Faculty Senate after approval.

**Substantive Change:** Department routes according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty. Forward three originally signed forms to one of the following (please check all that apply and send to first council/committee marked). If proposal needs to go through more than one council/committee, forward one additional form for each additional council/committee marked. See Senate Action 11-93/94 for definitions of substantive/non-substantive changes.

- College Council
- Professional Education Committee
- Committee on General Education and Intercollegiate Programs
- Graduate Council

Signature [Signature]  
Department Head

Date 1-28-15

Missouri State University  
Curricular Proposal Course Change or Deletion

11

Department PAMS

Date January 16, 2015

Check one: This is a change to X an existing COURSE      an existing REGULAR (i.e. permanent) SECTION of a variable content course

Present Course Code and Number AST 317 Course Title Our Universe, the Final Frontier

Revised Catalog Description

AST 317 Our Universe, the Final Frontier

Prerequisite: **AST 113** or AST 114 or AST 115; and MTH 138 or above.

Modern views on the structure of the Universe: its past, present, and future. Topics include the structure and content of our Galaxy and other galaxies, clusters of galaxies, the Big Bang theory (including Inflation), and the eventual fate of our Universe. ~~Cannot receive credit for both AST 317 and AST 517.~~ **May only receive credit for one of AST 317, AST 517, or AST 617.**

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0

Typically offered: Spring (even-numbered years)

Complete New Catalog Information

AST 317 Our Universe, the Final Frontier

Prerequisite: AST 113 or AST 114 or AST 115; and MTH 138 or above.

Modern views on the structure of the Universe: its past, present, and future. Topics include the structure and content of our Galaxy and other galaxies, clusters of galaxies, the Big Bang theory (including Inflation), and the eventual fate of our Universe. **May only receive credit for one of AST 317, AST 517, or AST 617.**

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0

Typically offered: Spring (even-numbered years)

What is changing? Check all boxes that apply.

- Course Deletion     Course Code     Course Number     Title     Prerequisite
- Credit Hours/Contact Hours     Periodicity     Description

Reason for Proposed Change or Deletion

Updating to reflect General Education Course AST 113.

How Did You Determine the Need For This Change or Deletion?

Currently, students taking AST 113 would not meet the astronomy prerequisite for AST 317, though they should.

Check if this is a **non-substantive** change. Distribution for non-substantive changes of 100- through 500-level courses: two originally-signed copies to Faculty Senate; 600- through 900-level courses: three originally-signed copies to Graduate Council. Graduate Council will give two copies to Faculty Senate after approval.

**Substantive Change:** Department routes according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty. Forward three originally signed forms to one of the following (please check all that apply and send to first council/committee marked). If proposal needs to go through more than one council/committee, forward one additional form for each additional council/committee marked. See Senate Action 11-93/94 for definitions of substantive/non-substantive changes.

College Council

Professional Education Committee

Committee on General Education and Intercollegiate Programs

Graduate Council

Signature

Department Head

Date

1-23-15

(Routing on Reverse Side)

Missouri State University  
Curricular Proposal Course Change or Deletion

12

Department PAMS

Date January 16, 2015

Check one: This is a change to X an existing COURSE      an existing REGULAR (i.e. permanent) SECTION of a variable content course

Present Course Code and Number AST 513 Course Title Solar and Extra-Solar Systems

Revised Catalog Description

AST 513 Solar and Extra-Solar Systems

Prerequisite: **AST 113** or *AST 114 or 115*; and *MTH 303*.

Formation of planetary systems, planetary dynamics, and comparative planetology. Project required. ~~Cannot receive credit for both AST 313 and AST 513. May be taught concurrently with AST 313 and/or 613. Cannot receive credit for both AST 613 and AST 513.~~ **May only receive credit for one of AST 313, AST 513, or AST 613.**

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0  
Typically offered: Fall (odd-numbered years)

Complete New Catalog Information

AST 513 Solar and Extra-Solar Systems

Prerequisite: *AST 113 or AST 114 or 115; and MTH 303.*

Formation of planetary systems, planetary dynamics, and comparative planetology. Project required. May be taught concurrently with AST 313 and/or 613. *May only receive credit for one of AST 313, AST 513, or AST 613.*

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0  
Typically offered: Fall (odd-numbered years)

What is changing? Check all boxes that apply.

- Course Deletion     Course Code     Course Number     Title     Prerequisite
- Credit Hours/Contact Hours     Periodicity     Description

Reason for Proposed Change or Deletion

Updating to reflect General Education Course AST 113.

How Did You Determine the Need For This Change or Deletion?

Currently, students taking AST 113 would not meet the prerequisites for AST 513, though they should.

Check if this is a **non-substantive** change. Distribution for non-substantive changes of 100- through 500-level courses: two originally-signed copies to Faculty Senate; 600- through 900-level courses: three originally-signed copies to Graduate Council. Graduate Council will give two copies to Faculty Senate after approval.

**Substantive Change:** Department routes according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty. Forward three originally signed forms to me of the following (please check all that apply and send to first council/committee marked). If proposal needs to go through more than one council/committee, forward one additional form for each additional council/committee marked. See Senate Action 11-93/94 for definitions of substantive/non-substantive changes.

- College Council
- Professional Education Committee
- Committee on General Education and Intercollegiate Programs
- Graduate Council

Signature   
Department Head

Date 1-23-15



Missouri State University  
Curricular Proposal Course Change or Deletion

12

Department PAMS

Date January 16, 2015

Check one: This is a change to X an existing COURSE      an existing REGULAR (i.e. permanent) SECTION of a variable content course

Present Course Code and Number AST 613 Course Title Solar and Extra-Solar Systems

Revised Catalog Description

AST 613 Solar and Extra-Solar Systems

Prerequisite: **AST 113** or **AST 114** or **AST 115**; and **MTH 303**.

Formation of planetary systems, planetary dynamics, and comparative planetology. Project required. ~~Cannot receive credit for both AST 313 and AST 513.~~ May be taught concurrently with **AST 313 and/or 513.** ~~Cannot receive credit for both AST 513 and AST 613.~~ **May only receive credit for one of AST 313, AST 513, or AST 613.**

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0  
Typically offered: Fall (odd-numbered years)

Complete New Catalog Information

AST 613 Solar and Extra-Solar Systems

Prerequisite: **AST 113** or **AST 114** or **AST 115**; and **MTH 303**.

Formation of planetary systems, planetary dynamics, and comparative planetology. Project required. May be taught concurrently with **AST 313 and/or 513.** **May only receive credit for one of AST 313, AST 513, or AST 613.**

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0  
Typically offered: Fall (odd-numbered years)

What is changing? Check all boxes that apply.

- Course Deletion     Course Code     Course Number     Title     Prerequisite
- Credit Hours/Contact Hours     Periodicity     Description

Reason for Proposed Change or Deletion

Updating to reflect General Education Course AST 113.

How Did You Determine the Need For This Change or Deletion?

Currently, students taking AST 113 would not meet the prerequisites for AST 613, though they should.

Check if this is a **non-substantive** change. Distribution for non-substantive changes of 100- through 500-level courses: two originally-signed copies to Faculty Senate; 600- through 900-level courses: three originally-signed copies to Graduate Council. Graduate Council will give two copies to Faculty Senate after approval.

**Substantive Change:** Department routes according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty. Forward three originally signed forms to one of the following (please check all that apply and send to first council/committee marked). If proposal needs to go through more than one council/committee, forward one additional form for each additional council/committee marked. See Senate Action 11-93/94 for definitions of substantive/non-substantive changes.

- College Council
- Professional Education Committee
- Committee on General Education and Intercollegiate Programs
- Graduate Council

Signature Dal Miller  
Department Head

Date 1-23-15

Missouri State University  
Curricular Proposal Course Change or Deletion

13

Department PAMS

Date January 16, 2015

Check one: This is a change to X an existing COURSE     an existing REGULAR (i.e. permanent) SECTION of a variable content course

Present Course Code and Number AST 515 Course Title Stellar Structure and Evolution

Revised Catalog Description

AST 515 Stellar Structure and Evolution

Prerequisite: **AST 113** or AST 114 or 115; and MTH 303.

Basic concepts of stellar structure, atmospheres, and evolution. Project required. ~~Cannot receive credit for both AST 315 and AST 515.~~ May be taught concurrently with AST 315 and/or 615. ~~Cannot receive credit for both AST 615 and AST 515.~~ **May only receive credit for one of AST 315, AST 515, or AST 615.**

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0

Typically offered: Spring (odd-numbered years)

Complete New Catalog Information

AST 515 Stellar Structure and Evolution

Prerequisite: AST 113 or AST 114 or 115; and MTH 303.

Basic concepts of stellar structure, atmospheres, and evolution. Project required. May be taught concurrently with AST 315 and/or 615. *May only receive credit for one of AST 315, AST 515, or AST 615.*

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0

Typically offered: Spring (odd-numbered years)

What is changing? Check all boxes that apply.

- Course Deletion     Course Code                       Course Number     Title                      X Prerequisite
- Credit Hours/Contact Hours                       Periodicity                      X Description

Reason for Proposed Change or Deletion

Updating to reflect General Education Course AST 113.

How Did You Determine the Need For This Change or Deletion?

Currently, students taking AST 113 would not meet the astronomy prerequisite for AST 515, though they should.

Check if this is a **non-substantive** change. Distribution for non-substantive changes of 100- through 500-level courses: two originally-signed copies to Faculty Senate; 600- through 900-level courses: three originally-signed copies to Graduate Council. Graduate Council will give two copies to Faculty Senate after approval.

**Substantive Change:** Department routes according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty. Forward three originally signed forms to one of the following (please check all that apply and send to first council/committee marked). If proposal needs to go through more than one council/committee, forward one additional form for each additional council/committee marked. See Senate Action 11-93/94 for definitions of substantive/non-substantive changes.

College Council

Professional Education Committee

Committee on General Education and Intercollegiate Programs

Graduate Council

Signature [Signature]  
Department Head

Date 1-23-15

(Routing on Reverse Side)

Missouri State University  
Curricular Proposal Course Change or Deletion

13

Department PAMS

Date January 16, 2015

Check one: This is a change to X an existing COURSE \_\_\_ an existing REGULAR (i.e. permanent) SECTION of a variable content course

Present Course Code and Number AST 615 Course Title Stellar Structure and Evolution

Revised Catalog Description

AST 615 Stellar Structure and Evolution

Prerequisite: **AST 113 or AST 114 or AST 115; and MTH 303.**

Basic concepts of stellar structure, atmospheres, and evolution. Project required. ~~Cannot receive credit for both AST 315 and AST 615. May be taught concurrently with AST 315 and/or 615. Cannot receive credit for both AST 515 and AST 615. May only receive credit for one of AST 315, AST 515, or AST 615.~~

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0

Typically offered: Spring (odd-numbered years)

Complete New Catalog Information

AST 615 Stellar Structure and Evolution

Prerequisite: **AST 113 or AST 114 or AST 115; and MTH 303.**

Basic concepts of stellar structure, atmospheres, and evolution. Project required. May be taught concurrently with AST 315 and/or 515. *May only receive credit for one of AST 315, AST 515, or AST 615.*

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0

Typically offered: Spring (odd-numbered years)

What is changing? Check all boxes that apply.

- Course Deletion     Course Code     Course Number     Title     Prerequisite
- Credit Hours/Contact Hours     Periodicity     Description

Reason for Proposed Change or Deletion

Updating to reflect General Education Course AST 113.

How Did You Determine the Need For This Change or Deletion?

Currently, students taking AST 113 would not meet the astronomy prerequisite for AST 615, though they should.

Check if this is a **non-substantive** change. Distribution for non-substantive changes of 100- through 500-level courses: two originally-signed copies to Faculty Senate; 600- through 900-level courses: three originally-signed copies to Graduate Council. Graduate Council will give two copies to Faculty Senate after approval.

**Substantive Change:** Department routes according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty. Forward three originally signed forms to one of the following (please check all that apply and send to first council/committee marked). If proposal needs to go through more than one council/committee, forward one additional form for each additional council/committee marked. See Senate Action 11-93/94 for definitions of substantive/non-substantive changes.

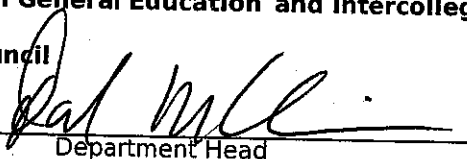
College Council

Professional Education Committee

Committee on General Education and Intercollegiate Programs

Graduate Council

Signature

  
Department Head

Date

1-23-15

Missouri State University  
Curricular Proposal Course Change or Deletion

14

Department PAMS

Date January 16, 2015

Check one: This is a change to X an existing COURSE      an existing REGULAR (i.e. permanent) SECTION of a variable content course

Present Course Code and Number AST 517 Course Title Galaxies and Cosmology

Revised Catalog Description

AST 517 Galaxies and Cosmology

Prerequisite: **AST 113** or AST 114 or 115; and MTH 303.

Study of galaxies and the Universe. Topics include the structure and content of our Galaxy and other galaxies, clusters of galaxies, the Big Bang theory (including Inflation), and the eventual fate of our Universe. Project required. ~~Cannot receive credit for both AST 317 and AST 517.~~ May be taught concurrently with AST 317 and/or 617. ~~Cannot receive credit for both AST 617 and AST 517.~~ **May only receive credit for one of AST 317, AST 517, or AST 617.**

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0

Typically offered: Spring (even-numbered years)

Complete New Catalog Information

AST 517 Galaxies and Cosmology

Prerequisite: AST 113 or AST 114 or 115; and MTH 303.

Study of galaxies and the Universe. Topics include the structure and content of our Galaxy and other galaxies, clusters of galaxies, the Big Bang theory (including Inflation), and the eventual fate of our Universe. Project required. May be taught concurrently with AST 317 and/or 617. *May only receive credit for one of AST 317, AST 517, or AST 617.*

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0

Typically offered: Spring (even-numbered years)

What is changing? Check all boxes that apply.

- Course Deletion     Course Code     Course Number     Title     Prerequisite
- Credit Hours/Contact Hours     Periodicity     Description

Reason for Proposed Change or Deletion

Updating to reflect General Education Course AST 113.

How Did You Determine the Need For This Change or Deletion?

Currently, students taking AST 113 would not meet the astronomy prerequisite for AST 517, though they should.

Check if this is a **non-substantive** change. Distribution for non-substantive changes of 100- through 500-level courses: two originally-signed copies to Faculty Senate; 600- through 900-level courses: three originally-signed copies to Graduate Council. Graduate Council will give two copies to Faculty Senate after approval.

**Substantive Change:** Department routes according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty. Forward three originally signed forms to one of the following (please check all that apply and send to first council/committee marked). If proposal needs to go through more than one council/committee, forward one additional form for each additional council/committee marked. See Senate Action 11-93/94 for definitions of substantive/non-substantive changes.

College Council

Professional Education Committee

Committee on General Education and Intercollegiate Programs

Graduate Council

Signature [Signature]  
Department Head

Date 1-23-15

Missouri State University  
Curricular Proposal Course Change or Deletion

14

Department PAMS

Date January 16, 2015

Check one: This is a change to X an existing COURSE      an existing REGULAR (i.e. permanent) SECTION of a variable content course

Present Course Code and Number AST 617 Course Title Galaxies and Cosmology

Revised Catalog Description

AST 617 Galaxies and Cosmology

Prerequisite: **AST 113 or AST 114 or AST 115; and MTH 303.**

Study of galaxies and the Universe. Topics include the structure and content of our Galaxy and other galaxies, clusters of galaxies, the Big Bang theory (including Inflation), and the eventual fate of our Universe. Project required. ~~Cannot receive credit for both AST 317 and AST 517.~~ May be taught concurrently with AST 317 and/or 517. ~~Cannot receive credit for both AST 517 and AST 617.~~ **May only receive credit for one of AST 317, AST 517, or AST 617.**

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0  
Typically offered: Spring (even-numbered years)

Complete New Catalog Information

AST 617 Galaxies and Cosmology

Prerequisite: *AST 113 or AST 114 or AST 115; and MTH 303.*

Study of galaxies and the Universe. Topics include the structure and content of our Galaxy and other galaxies, clusters of galaxies, the Big Bang theory (including Inflation), and the eventual fate of our Universe. Project required. May be taught concurrently with AST 317 and/or 517. *May only receive credit for one of AST 317, AST 517, or AST 617.*

Credit hours: 3 Lecture contact hours: 3 Lab contact hours: 0  
Typically offered: Spring (even-numbered years)

What is changing? Check all boxes that apply.

- Course Deletion     Course Code     Course Number     Title     Prerequisite
- Credit Hours/Contact Hours     Periodicity     Description

Reason for Proposed Change or Deletion

Updating to reflect General Education Course AST 113.

How Did You Determine the Need For This Change or Deletion?

Currently, students taking AST 113 would not meet the astronomy prerequisite for AST 617, though they should.

Check if this is a **non-substantive** change. Distribution for non-substantive changes of 100- through 500-level courses: two originally-signed copies to Faculty Senate; 600- through 900-level courses: three originally-signed copies to Graduate Council. Graduate Council will give two copies to Faculty Senate after approval.

**Substantive Change:** Department routes according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty. Forward three originally signed forms to me of the following (please check all that apply and send to first council/committee marked). If proposal needs to go through more than one council/committee, forward one additional form for each additional council/committee marked. See Senate Action 11-93/94 for definitions of substantive/non-substantive changes.

- College Council
- Professional Education Committee
- Committee on General Education and Intercollegiate Programs

Graduate Council  
Signature [Signature]  
Department Head

Date 1-23-15

15

# Missouri State University Curricular Proposal Course Change or Deletion

Department Physics, Astronomy, and Materials Science

Date January 16, 2015

Check one: This is a change to  an existing COURSE  
 an existing REGULAR (i.e. permanent) SECTION of a variable content course

Present Course Code and Number PHY 233 Course Title Engineering Statics

Revised Catalog Description (Copy/paste present description from online catalog, strikethrough all deletions, and insert/bold new information.)

PHY 233 Engineering Statics Prerequisite: **C or better in MTH 280 and PHY 203.** Application of mechanics to equilibrium problems; topics include principles of center of mass, resultant force, friction, moment of inertia, torque, etc. Course does not satisfy any requirement for a physics major or minor. Credit hours: 3. Lecture contact hours: 3. Lab contact hours: 0. Typically offered: Spring, Fall

### Complete New Catalog Information

PHY 233 Engineering Statics Prerequisite: *C or better in MTH 280 and PHY 203.* Application of mechanics to equilibrium problems; topics include principles of center of mass, resultant force, friction, moment of inertia, torque, etc. Course does not satisfy any requirement for a physics major or minor. Credit hours: 3. Lecture contact hours: 3. Lab contact hours: 0. Typically offered: Spring, Fall

### What is changing? Check all boxes that apply.

- Course Deletion
- Course Code
- Course Number
- Title
- Prerequisite
- Credit Hours/Contact Hours
- Periodicity
- Description

### Reason for Proposed Change or Deletion

### How Did You Determine the Need For This Change or Deletion?

Without the prerequisite change, the course is unsuitable for a large fraction of the current student pool which currently takes it. The change is necessary to keep the course viable. Periodicity reflects current offering.

Check if this is a non-substantive change. Distribution for non-substantive changes of 100- through 500-level courses: two originally-signed copies to Faculty Senate; 600- through 900-level courses: three originally-signed copies to Graduate Council. Graduate Council will give two copies to Faculty Senate after approval.

**Substantive Change:** Department routes according to ART VI, SEC 3B(1-4) of Bylaws of the Faculty. Forward three originally signed forms to one of the following (please check all that apply and send to first council/committee marked). If proposal needs to go through more than one council/committee, forward one additional form for each additional council/committee marked. See Senate Action 11-93/94 for definitions of substantive/non-substantive changes.

College Council

(All substantive course changes numbered 100-599 must go through College Council first. After approval, College Council will forward appropriate number of copies to the next committee/council or directly to the Faculty Senate if no further committee approval is needed. The last level of committee/council will forward two originally signed copies to the Faculty Senate.)

Professional Education Committee

(Considers all substantive course changes for Professional Education courses and Teaching Methods courses.)

Committee on General Education and Intercollegiate Programs

(Considers all substantive course changes for General Education and Intercollegiate Program proposals.)

Graduate Council

(Considers all 600-900 level course changes.)

Signature

*Paul M. C.*  
Department Head

Date

1-20-15

(Routing on Reverse Side)