MEMORANDUM

Date: September 25 2015
To: Dr. Mark Archambault, Chair, Undergraduate Curriculum Committee
CC'd: Dr. Hamid Rassoul, Dean, College of Science; Dr. Daniel Batcheldor, Head, Department of Physics and Space Sciences
From: Dr. Darin Ragozzine, Physics and Space Sciences
Re: Updated rearrangement of Astronomy & Astrophysics, Planetary Science, and Astrobiology Degree requirements (CGR for 7192, 7193, 7191 and CRC for SPS 4045)

The Physics and Space Sciences Department proposes a updated rearrangement of course requirements in order to synchronize teaching schedules and provide a little more flexibility to students. This necessitates a minimal addition of a co-requisite to SPS 4045 (Planet Formation). We also would like to add the new SPS 4050 – Advanced Research Techniques and Data Analysis class as a requirement for Astronomy & Astrophysics majors.

Two years ago, the UGCC approved the introduction of a new Planetary Science degree program. Despite significant planning at that time, we ended up with a course (Comparative Planetology) that was required to be taught every other fall by one program and every other spring by another program and every spring by a third program. With a minor rearrangements of requirements, we can facilitate a much more efficient program and provide students with the assurance and flexibility they need to complete these degree programs. We have considered several possibilities for the rearrangements and the following is by far the best and simplest result.

1) CGR – Planetary Science (7193)
Rearrange classes in the new Planetary Science major to improve coherence with other majors and thereby increase teaching efficiency. The only net change is to reverse the positions of SPS 4045 (Planet Formation) and SPS 4035 (Comparative Planetology) and a resulting minor prerequisite -> corequisite change. Since our requirements list out a specific program plan, this requires several individual changes:

1) In Junior Fall, change requirement from SPS 3010 (Geophysics) OR SPS 4035 (Comparative Planetology) to SPS 3010 OR SPS 4045 (Physics and Chemistry of Planet Formation).
2) In Junior Spring, change requirement from SPS 4025 (Intro to Space Plasma Physics) OR SPS 4045 (Planet Formation) to SPS 4025 OR SPS 4035 (Comparative)
3) In Senior Fall, change requirement from SPS 3010 (Geophysics) OR SPS 4035 (Comparative Planetology) to SPS 3010 OR SPS 4045 (Physics and Chemistry of Planet Formation).

4) In Senior Spring, change requirement from SPS 4025 (Intro to Space Plasma Physics) OR SPS 4045 (Planet Formation) to SPS 4025

This synchronizes these courses with other degree requirements, but otherwise has no effect.

2) CRC – SPS 4050 (Physics and Chemistry of Planet Formation)
The above change necessitates an associated minor Change in the Requirements of SPS 4045 so that Thermodynamics can be taken as a co-requisite or pre-requisite. In the new program, it is possible that students will take SPS 4045 (Planet Formation) in Junior Fall, the same time as they are taking PHY 3060 (Thermodynamics and Statistical Mechanics). Currently, PHY 3060 is a pre-requisite, we request to make it pre-requisite or co-requisite.

SPS 4045 has not yet been taught (it is only required by the new Planetary Science program and no students are to that phase yet; first offering planned in Fall 2016). The planned instructor for that class (me, Dr. Ragozzine) has taught an Independent Study to two students that was meant to substitute for this class. While thermodynamic quantities are discussed (e.g., the temperature and pressure of protoplanetary disks), they are not central to the course and basic thermodynamics is sufficient. This basic thermodynamics is generally taught in the first weeks of PHY 3060 and can be mildly augmented as needed in the Planet Formation class. Therefore, we do not feel that this change to PHY 3060 to a co-requisite will have any significant effect on the pedagogy of SPS 4045.

3) CGR – Astrobiology (7191)
The above changes make class coverage more efficient and synchronized with other programs. However, this affects one class of the Astrobiology program currently required in Senior Spring. In the new plan, SPS 4035 (Comparative Planetology) is only taught every other year. The Astrobiology program is extremely tight with currently zero electives; therefore we propose to replace SPS 4035 with "Restricted Elective (PHY/SPS 3xxx or higher)". This gives both students and the department a little more flexibility.

A wide variety of courses in the major are not currently required but very relevant possible restricted electives (e.g., PHY 4020 - Optics, SPS 3030 - Orbital Mechanics, SPS 4035 - Comparative Planetology, SPS 4045 - Planet Formation, SPS 4050 - Advanced Research Techniques & Data Analysis, Undergraduate Research, etc.).

This synchronizes these courses with other degree requirements, but otherwise has no effect.

3) CGR – Astronomy & Astrophysics (7192)
Summary: Replace Restricted Elective (PHY/SPS 3XXX or higher) with new SPS 4050 (Advanced Research Techniques and Data Analysis) in the Astronomy & Astrophysics Degree Program Plan (Senior Fall). No effects on other majors.

We propose to add a new course requirement. SPS 4050 - Advanced Research Techniques and Data Analysis (ARTData) to the Astronomy & Astrophysics Degree Program. ARTData was added as a new course in August 2015. Students absolutely need additional instruction in astrophysics/physics focused research skills. This benefits their time here as undergraduate researchers and significantly strengthens their prospects for graduate school or industry positions. The ARTData course was created to fill this important gap and while we appreciate the value of restricted electives, this class is as relevant and requisite of our students as our other courses. ARTData replaces the Restricted Elective in Spring Fall of the Astronomy & Astrophysics Program Plan. This is appropriate as one of the prerequisites for ARTData is MTH 3210 (Partial Differential Equations) which is in the Program Plan in Junior Spring.

There are no direct effects on other majors.

Note the following teaching schedule plans that will efficiently cover the needs of all these programs. We will make these available to advisors and students.
SPS 3010 – Geophysics – Odd Falls
SPS 4045 – Planet Formation – Even Falls
SPS 4035 – Comparative Planetology – Odd Springs
SPS 4025 – Intro to Space Plasma Physics – Even Springs
SPS 4050 – Astrophysics Research Techniques and Data Analysis – All Falls

We request that the Undergraduate Curriculum Committee approve our application to Change the Graduate Requirements for Astronomy & Astrophysics (7192), Planetary Science (7193), and Astrobiology (7191) Degree Programs and the associated Change in Requirements of a Course for SPS 4045 (Planet Formation).

Regards,
Darin

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Dr. Darin Ragozzine
Assistant Professor
Dept. of Physics & Space Sciences
Florida Institute of Technology
DRagozzine@fit.edu, 321-674-7207
The addition or removal of any graduation requirement in a major or minor requires that this form, accompanied by supporting documentation, be completed and approved as indicated below. Incomplete or incorrect forms will not be processed.

**Florida Institute of Technology**

**CHANGING GRADUATION REQUIREMENTS IN A MAJOR/MINOR**

**COLLEGE:** College of Science  
**DEPARTMENT:** Physics and Space Sciences

**DEGREE LEVEL:** Bachelors of Science  
**PROGRAM TITLE:** Planetary Science

**TO BE INITIATED WITH CATALOG YEAR:** 2016/2017  
**CHANGE REQUESTED FOR:** □ major program  □ minor program  7193

Program changes are effective beginning with the fall term in which they appear in the University Catalog.

☐ Yes  ☐ No  Will this change impact the program's assessment process? If yes, attach a description of how the assessment will be impacted and the new process.

**DESCRIPTION OF REQUESTED CHANGES**  
Attach a more detailed description and any supporting documentation

Summary: Rearrange classes in the new Planetary Science major to improve coherence with other majors and thereby increase teaching efficiency. The only net change is to reverse the positions of SPS 4045 (Planet Formation) and SPS 4035 (Comparative Planetology) and a resulting minor prerequisite -> corequisite change. Since our requirements list this specific program plan, this requires several individual changes:

1) In Junior Fall, change requirement from SPS 3010 (Geophysics) OR SPS 4035 (Comparative Planetology) to SPS 3010 OR SPS 4045 (Physics and Chemistry of Planet Formation).

2) For students taking SPS 4045 in Junior year, this necessitates an associated minor change in the Requirements of SPS 4045 so that Thermodynamics can be taken as a co-requisite or pre-requisite. CRC form attached.

3) In Junior Spring, change requirement from SPS 4025 (Intro to Space Plasma Physics) OR SPS 4045 (Planet Formation) to SPS 4025 OR SPS 4035 (Comparative)

3) In Senior Fall, change requirement from SPS 3010 (Geophysics) OR SPS 4035 (Comparative Planetology) to SPS 3010 OR SPS 4045 (Physics and Chemistry of Planet Formation).

4) In Senior Spring, change requirement from SPS 4025 (Intro to Space Plasma Physics) OR SPS 4045 (Planet Formation) to SPS 4025

Two years ago, we introduced the new Planetary Science major which included creating and organizing a program plan. In implementing this plan and planning our teaching load, it became apparent that there was a minor error in that an every-other-year class was listed in the opposite semesters in two different programs. In order to synchronize the teaching, we are reversing the positions of SPS 4035 (Comparative Planetology) which is also taken by Astrophysics majors (and will now be in synch) and SPS 4045 (Planet Formation) which is a new as-yet-untought class that doesn't affect other majors. We explored many possible solutions and this was the best by far.

**Approvals:** On completion of appropriate department approvals, submit form to Chair, Graduate Council, or Chair, Undergraduate Curriculum Committee, for approval below and forward to the Catalog & Curriculum Manager.

**Dean Rappaz  9/24/15**  
**Date**  
**Chiar, Graduate Council**  
**Date**

**Department Head / Major Program Chair  9/24/15**  
**Date**  
**Chair, Undergraduate Curriculum Committee**  
**Date**

**Dean or Associate Dean  9/25/15**  
**Date**

REGISTRAR'S USE ONLY

**CAPP / Degree Evaluation**  
☐ Yes  ☐ No  Update completed  
**Academic Year**  
**Date**  
**Initials**

**Catalog Management System**  
☐ Yes  ☐ No  Update completed  
**Academic Year**  
**Date**  
**Initials**

Florida Institute of Technology  
Office of the Registrar

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11/16/2015
PLANETARY SCIENCE CURRENT
DARIN RAGOZZINE

Freshman Fall (16 Credit Hours)
ASC 1000 University Experience
CHM 1101 General Chemistry 1
COM 1101 Composition and Rhetoric
MTH 1001 Calculus 1 *
PHY 1050 Physics and Space Science Seminar
SPS 1020 Introduction to Space Sciences *

Freshman Spring (16 Credit Hours)
CHM 1102 General Chemistry 2
COM 1102 Writing About Literature
MTH 1002 Calculus 2
PHY 1001 Physics 1
PHY 2091 Physics Laboratory 1

Sophomore Fall (15 Credit Hours)
HUM 2051 Civilization 1: Ancient Through Medieval
MTH 2001 Calculus 3
PHY 2002 Physics 2
PHY 2092 Physics Laboratory 2
Restricted Elective (CSE 15xx) Credit Hours: 3

Sophomore Spring (16 Credit Hours)
COM 2223 Scientific and Technical Communication
MTH 2201 Differential Equations/Linear Algebra
PHY 2003 Modern Physics
SPS 2010 Observational Astronomy
Humanities Core Course Credit Hours: 3

Junior Fall (17 Credit Hours)
MTH 3210 Introduction to Partial Differential Equations and Applications
PHY 3011 Physical Mechanics
PHY 3060 Thermodynamics, Kinetic Theory and Statistical Mechanics
MET 4233 Remote Sensing for Meteorology OR OCN 4704 Remote Sensing for Oceanography
SPS 3010 Geophysics** OR SPS 4035 Comparative Planetology **

Junior Spring (17 Credit Hours)
PHY 3035 Quantum Mechanics
PHY 3152 Electronic Measurement Techniques
PHY 3440 Electromagnetic Theory
SPS 3030 Orbital Mechanics
SPS 4025 Introduction to Space Plasma Physics** OR SPS 4045 Physics and Chemistry of Planet Formation **

Senior Fall (17 Credit Hours)
PHY 4020 Optics
PHY 4021 Experiments in Optics
SPS 4010 Astrophysics 1: Introduction to Stellar Structure and Evolution
SPS 4200 Senior Seminar 1
Humanities Elective Credit Hours: 3
Technical Elective or Undergraduate Research Credit Hours: 3
SPS 4035 Comparative Planetology** OR SPS 3010 Geophysics **

Senior Spring (15 Credit Hours)
SPS 4030 Physics of the Atmosphere
SPS 4110 Senior Laboratory
SPS 4210 Senior Seminar 2
Social Science Elective Credit Hours: 3
Technical Elective or Undergraduate Research Credit Hours: 3
SPS 4025 Introduction to Space Plasma Physics OR SPS 4045 Physics and Chemistry of Planet Formation **

Total Credits Required: 129
Freshman Fall (16 Credit Hours)
ASC 1000 University Experience
CHM 1101 General Chemistry 1
COM 1101 Composition and Rhetoric
MTH 1001 Calculus 1 *
PHY 1050 Physics and Space Science Seminar
SPS 1020 Introduction to Space Sciences *

Freshman Spring (16 Credit Hours)
CHM 1102 General Chemistry 2
COM 1102 Writing About Literature
MTH 1002 Calculus 2
PHY 1001 Physics 1
PHY 2091 Physics Laboratory 1

Sophomore Fall (15 Credit Hours)
HUM 2051 Civilization 1: Ancient Through Medieval
MTH 2001 Calculus 3
PHY 2002 Physics 2
PHY 2092 Physics Laboratory 2
Restricted Elective (CSE 15xx) Credit Hours: 3

Sophomore Spring (16 Credit Hours)
COM 2223 Scientific and Technical Communication
MTH 2201 Differential Equations/Linear Algebra
PHY 2003 Modern Physics
SPS 2010 Observational Astronomy
Humanities Core Course Credit Hours: 3

Junior Fall (17 Credit Hours)
MTH 3210 Introduction to Partial Differential Equations and Applications
PHY 3011 Physical Mechanics
PHY 3060 Thermodynamics, Kinetic Theory and Statistical Mechanics
MET 4233 Remote Sensing for Meteorology OR OCN 4704 Remote Sensing for Oceanography
SPS 3010 Geophysics** OR SPS 4045 Physics and Chemistry of Planet Formation **

Junior Spring (17 Credit Hours)
PHY 3035 Quantum Mechanics
PHY 3152 Electronic Measurement Techniques
PHY 3440 Electromagnetic Theory
SPS 3030 Orbital Mechanics
SPS 4025 Introduction to Space Plasma Physics** OR SPS 4035 Comparative Planetology **

Senior Fall (17 Credit Hours)
PHY 4020 Optics
PHY 4010 Astrophysics 1: Introduction to Stellar Structure and Evolution
SPS 4200 Senior Seminar 1
Humanities Elective Credit Hours: 3
Technical Elective or Undergraduate Research Credit Hours: 3
SPS 4045 Physics and Chemistry of Planet Formation ** OR SPS 3010 Geophysics **

Senior Spring (15 Credit Hours)
SPS 4030 Physics of the Atmosphere
SPS 4110 Senior Laboratory
SPS 4210 Senior Seminar 2
Social Science Elective Credit Hours: 3
Technical Elective or Undergraduate Research Credit Hours: 3
SPS 4025 Introduction to Space Plasma Physics ** OR SPS 4035 Comparative Planetology **

Total Credits Required: 129
REQUEST TO CHANGE THE REQUIREMENTS FOR A COURSE

Any change, addition or removal of any restriction, or change in credit hours or availability for a course requires this form, accompanied by any supporting documentation, be completed and approved as indicated below.

COLLEGE: College of Science

DEPARTMENT: Physics and Space Sciences

REQUEST IS FOR CHANGE IN COURSE: SPS4045

Physics and Chemistry of Planet Formation

TO BE INCLUDED IN 2016/2017 CATALOG

Course changes are effective beginning with the fall term in which they appear in the University Catalog.

IS REQUEST FOR A CHANGE IN THE NAME LISTED ABOVE? □ Yes □ No If yes, requested name

IS REQUEST FOR A CHANGE IN CREDITS FOR COURSE LISTED ABOVE? □ Yes □ No If yes, current credits requested credits

IS REQUEST TO CHANGE RESTRICTIONS FOR COURSE LISTED ABOVE? □ Yes □ No If yes, please check all that apply:

☐ Add ☐ Remove ☐ Prerequisite ☐ Corequisite PHY3080

☐ Add ☐ Remove ☐ Prerequisite ☐ Corequisite

☐ Add ☐ Remove ☐ Other Restrictions* □ Yes □ No If yes, please use box below:

*Other restrictions may include changing the grade mode (P/F, S/U, A-F, ECU), deactivating a course already in the system, majors or class levels restricted from registration, or other restrictions.

☐ Yes □ No Is this request for the course to be used to measure program-level student learning outcomes?

☐ Yes □ No Is this request for the course to satisfy the scholarly inquiry requirement? If yes, attach "Q" materials for review.

☐ Yes □ No Will this change impact any existing programs? If yes, attach "Changing Graduation Requirements" form for each program that is impacted.

APPROVALS: Once appropriate department approvals are completed, submit form to Chair, Graduate Council, or Chair, Undergraduate Curriculum Committee for signatures below and forward to the Catalog & Curriculum Manager.

1) Original

[Signature]

9/24/15

Date

2) Department Head/Program Chair

[Signature]

9/24/15

Date

3) Dean or Associate Dean

[Signature]

9/25/15

Date

CATALOG & CURRICULUM MANAGER'S USE ONLY

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SCAPREQ

SCACRSE

Operator Initials

Date

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The addition or removal of any graduation requirement in a major or minor requires that this form, accompanied by supporting documentation, be completed and approved as indicated below. Incomplete or incorrect forms will not be processed.

COLLEGE College of Science

DEPARTMENT Physics and Space Sciences

DEGREE LEVEL Bachelors of Science

PROGRAM TITLE Astrobiology

TO BE INITIATED WITH CATALOG YEAR 2016/2017

CHANGE REQUESTED FOR □ major program □ minor program 7191

Major/Minor Code

Program changes are effective beginning with the fall term in which they appear in the University Catalog.

☐ Yes ☐ No Will this change impact the program's assessment process? If yes, attach a description of how the assessment will be impacted and the new process.

DESCRIPTION OF REQUESTED CHANGES Attach a more detailed description and any supporting documentation

To make class coverage more efficient and synchronized with other programs, a class currently required in Senior Spring (SPS 4035 - Comparative Planetology) is only taught every other year. The Astrobiology program is extremely tight with currently 6 electives; therefore we propose to replace SPS 4035 with "Restricted Elective (PHY/SPS 3xxx or higher)". This gives both students and the department a little more flexibility.

A wide variety of courses in the major are not currently required but very relevant possible restricted electives (e.g., PHY 4020 - Optics, SPS 3030 - Orbital Mechanics, SPS 4035 - Comparative Planetology, SPS 4045 - Planet Formation, SPS 4050 - Advanced Research Techniques & Data Analysis, Undergraduate Research, etc.).

Appraosals: On completion of appropriate department approvals, submit form to Chair, Graduate Council, or Chair, Undergraduate Curriculum Committee, for approval below and forward to the Catalog & Curriculum Manager.

Originator

Chair, Graduate Council

Date 4/24/15

Date

OR

Department Head / Major Program Chair

Chair, Undergraduate Curriculum Committee

Date 9/24/15

Date

Dean or Associate Dean

Date 9/25/15

Date

REGISTRAR'S USE ONLY

CAPP / Degree Evaluation □ Yes □ No Update completed Academic Year Date initials

Catalog Management System □ Yes □ No Update completed Academic Year Date initials
ASTROBIOLOGY AS-EXISTING  
DARIN RAGOZZINE

Freshman Fall (16 Credit Hours)  
ASC 1000 University Experience  
CHM 1101 General Chemistry 1  
COM 1101 Composition and Rhetoric  
MTH 1001 Calculus 1 *  
PHY 1050 Physics and Space Science Seminar  
SPS 1020 Introduction to Space Sciences *

Freshman Spring (16 Credit Hours)  
CHM 1102 General Chemistry 2  
COM 1102 Writing About Literature  
MTH 1002 Calculus 2  
PHY 1001 Physics 1  
PHY 2091 Physics Laboratory 1

Sophomore Fall (16 Credit Hours)  
BIO 1010 Biological Discovery 1  
HUM 2051 Civilization 1: Ancient Through Medieval  
MTH 2001 Calculus 3  
PHY 2002 Physics 2  
PHY 2092 Physics Laboratory 2

Sophomore Spring (17 Credit Hours)  
BIO 1020 Biological Discovery 2  
COM 2223 Scientific and Technical Communication  
MTH 2201 Differential Equations/Linear Algebra  
PHY 2003 Modern Physics  
Restricted Elective (CSE 15xx) Credit Hours: 3

Junior Fall (17 Credit Hours)  
CHM 2001 Organic Chemistry 1  
PHY 3011 Physical Mechanics  
PHY 3060 Thermodynamics, Kinetic Theory and Statistical Mechanics  
Statistical Mechanics Credit Hours: 4**  
Humanities Core Course Credit Hours: 3  
Humanities Elective Credit Hours: 3

Junior Spring (17 Credit Hours)  
BIO 2010 Microbiology  
CHM 2002 Organic Chemistry 2  
PHY 3035 Quantum Mechanics **  
PHY 3440 Electromagnetic Theory  
SPS 4039 Astrobiology

Senior Fall (15 Credit Hours)  
BIO 2110 General Genetics  
BIO 4010 Biochemistry 1  
SPS 4010 Astrophysics 1: Introduction to Stellar Structure and Evolution  
SPS 4200 Senior Seminar 1  
Social Science Elective Credit Hours: 3

Senior Spring (14 Credit Hours)  
BIO 4101 Molecular Biology  
BIO 4110 Biochemistry 2  
**SPS 4035 Comparative Planetology**  
SPS 4210 Senior Seminar 2  
SPS 4030 Physics of the Atmosphere OR BIO 3701 Evolution

Total Credits Required: 128
Freshman Fall (16 Credit Hours)
ASC 1000 University Experience
CHM 1101 General Chemistry 1
COM 1101 Composition and Rhetoric
MTH 1001 Calculus 1 *
PHY 1050 Physics and Space Science Seminar
SPS 1020 Introduction to Space Sciences *

Freshman Spring (16 Credit Hours)
CHM 1102 General Chemistry 2
COM 1102 Writing About Literature
MTH 1002 Calculus 2
PHY 1001 Physics 1
PHY 2091 Physics Laboratory 1

Sophomore Fall (16 Credit Hours)
BIO 1010 Biological Discovery 1
HUM 2051 Civilization 1: Ancient Through Medieval
MTH 2001 Calculus 3
PHY 2002 Physics 2
PHY 2092 Physics Laboratory 2

Sophomore Spring (17 Credit Hours)
BIO 1020 Biological Discovery 2
COM 2223 Scientific and Technical Communication
MTH 2201 Differential Equations/Linear Algebra
PHY 2003 Modern Physics
Restricted Elective (CSE 15xx) Credit Hours: 3

Junior Fall (17 Credit Hours)
CHM 2001 Organic Chemistry 1
PHY 3011 Physical Mechanics
PHY 3060 Thermodynamics, Kinetic Theory and Statistical Mechanics
Statistical Mechanics Credit Hours: 4**
Humanities Core Course Credit Hours: 3
Humanities Elective Credit Hours: 3

Junior Spring (17 Credit Hours)
BIO 2010 Microbiology
CHM 2002 Organic Chemistry 2
PHY 3035 Quantum Mechanics **
PHY 3440 Electromagnetic Theory
SPS 4039 Astrobiology

Senior Fall (15 Credit Hours)
BIO 2110 General Genetics
BIO 4010 Biochemistry 1
SPS 4010 Astrophysics 1: Introduction to Stellar Structure and Evolution
SPS 4200 Senior Seminar 1
Social Science Elective Credit Hours: 3

Senior Spring (14 Credit Hours)
BIO 4101 Molecular Biology
BIO 4110 Biochemistry 2

PHY/SPS 3xxx or higher
SPS 4210 Senior Seminar 2
SPS 4030 Physics of the Atmosphere OR BIO 3701 Evolution

Total Credits Required: 128
The addition or removal of any graduation requirement in a major or minor requires that this form, accompanied by supporting documentation, be completed and approved as indicated below. Incomplete or incorrect forms will not be processed.

COLLEGE  College of Science

DEPARTMENT  Physics and Space Sciences

DEGREE LEVEL  Bachelors of Science

PROGRAM TITLE  Astronomy & Astrophysics

TO BE INITIATED WITH CATALOG YEAR 20_1_6 /20_1_7

CHANGE REQUESTED FOR □ major program □ minor program 7_1_9_2

Program changes are effective beginning with the fall term in which they appear in the University Catalog.

☐ Yes  ☐ No  Will this change impact the program’s assessment process? If yes, attach a description of how the assessment will be impacted and the new process.

DESCRIPTION OF REQUESTED CHANGES  Attach a more detailed description and any supporting documentation

Summary: Replace Restricted Elective (PHY/SPS 3XXX or higher) with new SPS 4050 (Advanced Research Techniques and Data Analysis) in the Astronomy & Astrophysics Degree Program Plan (Senior Fall). No effects on other majors.

We propose to add a new course requirement. SPS 4050 - Advanced Research Techniques and Data Analysis (ARTData) to the Astronomy & Astrophysics Degree Program. ARTData was added as a new course in August 2015. Students absolutely need additional instruction in astrophysics/physics focused research skills. This benefits their time here as undergraduate researchers and significantly strengthens their prospects for graduate school or industry positions. The ARTData course was created to fill this important gap and while we appreciate the value of restricted electives, this class is as relevant and requisite of our students as our other courses. ARTData replaces the Restricted Elective in Spring Fall of the Astronomy & Astrophysics Program Plan. This is appropriate as one of the prerequisites for ARTData is MTH 3210 (Partial Differential Equations) which is in the Program Plan in Junior Spring.

There are no direct effects on other majors.

Approvals: On completion of appropriate department approvals, submit form to Chair, Graduate Council, or Chair, Undergraduate Curriculum Committee, for approval below and forward to the Catalog & Curriculum Manager.

Orig

Date 9/24/15

Chair, Graduate Council

Date

OR

Date 9/25/15

Chair, Undergraduate Curriculum Committee

Date

REGISTRAR’S USE ONLY

CAPP / Degree Evaluation
☐ Yes  ☐ No  Update completed Date

Academic Year

Initials

Catalog Management System
☐ Yes  ☐ No  Update completed Date

Academic Year

Initials
ASTRONOMY & ASTROPHYSICS  SCIENCE CURRENT
DARIN RAGOZZINE

Freshman Fall (16 Credit Hours)
ASC 1000 University Experience
CHM 1101 General Chemistry 1
COM 1101 Composition and Rhetoric
MTH 1001 Calculus 1 *
PHY 1050 Physics and Space Science Seminar
SPS 1020 Introduction to Space Sciences *

Freshman Spring (16 Credit Hours)
CHM 1102 General Chemistry 2
COM 1102 Writing About Literature
MTH 1002 Calculus 2
PHY 1001 Physics 1
PHY 2091 Physics Laboratory 1

Sophomore Fall (15 Credit Hours)
HUM 2051 Civilization 1: Ancient Through Medieval
MTH 2001 Calculus 3
PHY 2002 Physics 2
PHY 2092 Physics Laboratory 2
Restricted Elective (CSE 15xx) Credit Hours: 3

Sophomore Spring (16 Credit Hours)
COM 2223 Scientific and Technical Communication
MTH 2201 Differential Equations/Linear Algebra
PHY 2003 Modern Physics
SPS 2010 Observational Astronomy
Humanities Core Course Credit Hours: 3

Junior Fall (17 Credit Hours)
PHY 3011 Physical Mechanics
PHY 3060 Thermodynamics, Kinetic Theory and Statistical Mechanics
SPS 3020 Methods and Instrumentation
Restricted Elective (MTH 3000-level or higher) Credit Hours: 3
Free Elective Credit Hours: 3

Junior Spring (16 Credit Hours)
MTH 3210 Introduction to Partial Differential Equations and Applications
PHY 3035 Quantum Mechanics
PHY 3440 Electromagnetic Theory
SPS 3030 Orbital Mechanics
Humanities Elective Credit Hours: 3

Senior Fall (17 Credit Hours)
PHY 4020 Optics
PHY 4021 Experiments in Optics
SPS 4010 Astrophysics 1: Introduction to Stellar Structure and Evolution
SPS 4200 Senior Seminar 1
Restricted Elective (3000-level or higher PHY or SPS**) Credit Hours: 3
Technical Elective or Undergraduate Research Credit Hours: 3
MAE 3161 Fluid Mechanics OR OCE 3030 Fluid Mechanics

Senior Spring (15 Credit Hours)
SPS 4020 Astrophysics 2: Galactic Structure and Cosmology
SPS 4110 Senior Laboratory
SPS 4210 Senior Seminar 2
Social Science Elective Credit Hours: 3
Technical Elective or Undergraduate Research Credit Hours: 3
SPS 4025 Introduction to Space Plasma Physics OR SPS 4035 Comparative Planetology

Total Credits Required: 128
**ASTRONOMY & ASTROPHYSICS  SCIENCE PROPOSED UGCC 10/2/15**

**DARIN RAGOZZINE**

Freshman Fall (16 Credit Hours)
- ASC 1000 University Experience
- CHM 1101 General Chemistry 1
- COM 1101 Composition and Rhetoric
- MTH 1001 Calculus 1 *
- PHY 1050 Physics and Space Science Seminar
- SPS 1020 Introduction to Space Sciences *

Freshman Spring (16 Credit Hours)
- CHM 1102 General Chemistry 2
- COM 1102 Writing About Literature
- MTH 1002 Calculus 2
- PHY 1001 Physics 1
- PHY 2091 Physics Laboratory 1

Sophomore Fall (15 Credit Hours)
- HUM 2051 Civilization 1: Ancient Through Medieval
- MTH 2001 Calculus 3
- PHY 2002 Physics 2
- PHY 2092 Physics Laboratory 2
- Restricted Elective (CSE 15xx) Credit Hours: 3

Sophomore Spring (16 Credit Hours)
- COM 2223 Scientific and Technical Communication
- MTH 2201 Differential Equations/Linear Algebra
- PHY 2003 Modern Physics
- SPS 2010 Observational Astronomy
- Humanities Core Course Credit Hours: 3

Junior Fall (17 Credit Hours)
- PHY 3011 Physical Mechanics
- PHY 3060 Thermodynamics, Kinetic Theory and Statistical Mechanics
- SPS 3020 Methods and Instrumentation
- Restricted Elective (MTH 3000-level or higher) Credit Hours: 3
- Free Elective Credit Hours: 3

Junior Spring (16 Credit Hours)
- MTH 3210 Introduction to Partial Differential Equations and Applications
- PHY 3035 Quantum Mechanics
- PHY 3440 Electromagnetic Theory
- SPS 3030 Orbital Mechanics
- Humanities Elective Credit Hours: 3

Senior Fall (17 Credit Hours)
- PHY 4020 Optics
- PHY 4021 Experiments in Optics
- SPS 4010 Astrophysics 1: Introduction to Stellar Structure and Evolution
- SPS 4200 Senior Seminar 1
- SPS 4050 Advanced Research Techniques and Data Analysis
- Technical Elective or Undergraduate Research Credit Hours: 3
- MAE 3161 Fluid Mechanics OR OCE 3030 Fluid Mechanics

Senior Spring (15 Credit Hours)
- SPS 4020 Astrophysics 2: Galactic Structure and Cosmology
- SPS 4110 Senior Laboratory
- SPS 4210 Senior Seminar 2
- Social Science Elective Credit Hours: 3
- Technical Elective or Undergraduate Research Credit Hours: 3
- SPS 4025 Introduction to Space Plasma Physics OR SPS 4035 Comparative Planetology

Total Credits Required: 128