Term Information

Effective Term	Spring 2019

General Information

Course Bulletin Listing/Subject Area	Astronomy
Fiscal Unit/Academic Org	Astronomy - D0614
College/Academic Group	Arts and Sciences
Level/Career	Undergraduate
Course Number/Catalog	1221
Course Title	Astronomy Data Analysis
Transcript Abbreviation	Astro Data
Course Description	Overview of data analysis in astronomy. The course will combine select topics in modern astronomy with contemporary data analysis methods implemented in the Python programming language, illustrating how astronomical data lead to scientific conclusions. It is intended for students with interest in astronomy and analysis of large data sets; prior astronomy experience not required.
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week, 12 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	No
Grading Basis	Letter Grade
Repeatable	No
Course Components	Lecture
Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites	Prereq or concur: Math 1141, 1151, or 1161.
Exclusions	
Electronically Enforced	Yes

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	40.0201
Subsidy Level	General Studies Course
Intended Rank	Freshman, Sophomore

Requirement/Elective Designation

General Education course:
Physical Science

Course Details

Course goals or learning objectives/outcomes

- Students will understand how astronomical data lead to conclusions about the physical nature of celestial objects and the universe.
- Students will understand how measurement uncertainties affect the ability to discover new phenomena and to infer physical properties.
- Students will understand the basic tools of astronomical data collection and the technology that underpins them.
- Students will develop the skills needed to use the Python programming language for data visualization and manipulation, for numerical modeling, and for numerical problem solving.

Content Topic List

- Solar System: planets, moons, asteroids, and the Sun. Analysis tools will include basic statistics, such as mean, median, standard deviation, distributions.
- Stars: main sequence, hydrostatic equilibrium, nucleosynthesis, physical properties. Analysis tools will include uncertainties, model regression.
- Exoplanets: discovery techniques, demographics of exoplanet systems. Analysis tools will include time series analysis.
- Milky Way: distribution of stars, shape of the Galaxy. Analysis tools will include database structure, query design, data mining.
- Galaxies: morphological types, sizes, distances, stellar populations. Analysis tools will include classification with machine learning.
- Dark Matter: velocities from galaxy spectra, galaxy rotation curves, galaxy clusters. Analysis tools will include model development and testing methods.
- Cosmology: expansion of the universe, Type Ia SN, Hubble diagram, dark energy. Analysis tools will include model development and testing methods.

Sought Concurrence

No

Attachments

- Astro1221-Syllabus.docx

  (Syllabus. Owner: Martini,Louis Paul)

- Astro1221-GE-AssessPlan.docx

  (GEC Course Assessment Plan. Owner: Martini,Louis Paul)

- Astro1221-GE-Rationale.docx

  (Other Supporting Documentation. Owner: Martini,Louis Paul)

- Astro1221-da.txt: Information from Data Analytics

  (Concurrence. Owner: Martini,Louis Paul)

- Astro1221-stat.txt: Concurrence from Statistics

  (Concurrence. Owner: Martini,Louis Paul)

- Astro1221-cse.txt: Concurrence from CSE (with name change)

  (Concurrence. Owner: Martini,Louis Paul)

Comments

- I requested concurrence from the Data Analytics major. That program referred me to statistics and CSE. I have attached concurrence from those two programs. CSE provided concurrent provided the course title not include 'Python.' We have made that change, both on this form and on the attached documents. *(by Martini,Louis Paul on 02/14/2018 04:53 PM)*
- Please seek concurrence from Data Analytics Major *(by Reed,Kathryn Marie on 11/14/2017 12:24 PM)*
- 10/31: I have added Math 1141 to the prereqs. *(by Haddad,Deborah Moore on 10/31/2017 03:59 PM)*
- See 10-12-17 email to P Martini. *(by Vankeerbergen,Bernadette Chantal on 10/12/2017 09:08 AM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Martini,Louis Paul	08/29/2017 09:02 PM	Submitted for Approval
Approved	Weinberg,David Hal	08/30/2017 12:50 PM	Unit Approval
Approved	Haddad,Deborah Moore	08/30/2017 01:49 PM	College Approval
Revision Requested	Vankeerbergen,Bernadette Chantal	10/12/2017 09:08 AM	ASCCAO Approval
Submitted	Martini,Louis Paul	10/30/2017 05:08 PM	Submitted for Approval
Approved	Weinberg,David Hal	10/31/2017 03:36 PM	Unit Approval
Approved	Haddad,Deborah Moore	10/31/2017 03:59 PM	College Approval
Approved	Vankeerbergen,Bernadette Chantal	11/08/2017 03:03 PM	ASCCAO Approval
Approved	Fink,Steven Scott	11/08/2017 05:39 PM	ASC Approval
Revision Requested	Reed,Kathryn Marie	11/14/2017 12:24 PM	OAA Approval
Submitted	Martini,Louis Paul	02/14/2018 04:53 PM	Submitted for Approval
Approved	Weinberg,David Hal	03/13/2018 04:40 PM	Unit Approval
Approved	Haddad,Deborah Moore	03/13/2018 05:23 PM	College Approval
Pending Approval	Nolen,Dawn Vankeerbergen,Bernadette Chantal Oldroyd,Shelby Quinn Hanlin,Deborah Kay Jenkins,Mary Ellen Bigler	03/13/2018 05:23 PM	ASCCAO Approval

Astronomy 1221 –Astronomy Data Analysis

Syllabus Template

Instructor: Astronomy Professor, Dept. of Astronomy
Office: 40XX McPherson Lab (4th floor), mailbox in 4055 McPherson Lab
Phone: 614-292-1773
Office Hours: by appointment
Email: astronomer@osu.edu

Format of Instruction and Meeting Times:
Lectures: Days, Times
Location: Place

Web Page: Available through http://carmen.osu.edu

Course Description

Astronomy 1221 is an overview of data analysis in astronomy. The course will cover select topics in modern astronomy, combined with contemporary data analysis methods, illustrate how these data lead to scientific conclusions, and the limitations of data. The intended audience for the course is students with an interest in astronomy and the analysis of large datasets. The course will use the python programming language. No prior knowledge of astronomy or python is necessary.

General Education Category and Expected Learning Outcomes

Astronomy 1221 is a General Education (GE) Physical Science course in the Natural Science category that is intended for BS and BA students. The goals of this category are: Students understand the principles, theories, and methods of modern science, the relationship between science and technology, the implications of scientific discoveries and the potential of science and technology to address problems of the contemporary world.

The expected learning outcomes for GE courses in the Natural Science category are as follows:

1. Students understand the basic facts, principles, theories, and methods of modern science.
2. Students understand key events in the development of science and recognize that science is an evolving body of knowledge.
3. Students describe the inter-dependence of scientific and technological developments.
4. Students recognize social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world.

Astronomy 1221 will satisfy these expected learning outcomes as follows:

(a) Students will understand how astronomical data lead to conclusions about the physical nature of celestial objects and the universe. Students will understand how measurement uncertainties affect the ability to discover new phenomena and to infer physical properties.

This will include analysis of data in: (1) “exploration mode” using visualization and classification to discover phenomena and identify patterns; (2) “model fitting and testing mode” using quantitative methods to infer values and uncertainties of model parameters and to test the validity of models. This maps to GE learning outcomes #1 and #2.

(b) Students will understand the basic tools of astronomical data collection and the technology that underpins them. This maps to GE learning outcomes #3 and #4.

(c) Students will develop the skills needed to use the Python programming language for data visualization and manipulation, for numerical modeling, and for numerical problem solving. Python has rapidly become the "lingua franca" for much astronomical data analysis and numerical computation, so these skills will be of great value to students in future courses in astronomy or other classes that involve numerical problem solving or analysis of data sets. This maps to GE learning outcomes #1, #3, and #4.

Prerequisites

The course is open to students with a strong interest in astronomy and modern methods of data analysis. Pre- or co-requisites are Math 1151 or 1161. There are no astronomy pre-requisites.

Textbook

There is no required textbook, although access to an introductory astronomy textbook will be useful. The course will also use many online tutorials for data analysis methods and python.

Grading Information

There will be an assignment for each of the astronomy and data analysis topics that will make use of the tools connected to those topics. These assignments will be due approximately every two weeks. Each assignment will have equal weight, and the total of the assignments will correspond to 80% of the course grade. There will also be a final project worth the other 20% of the course grade. The final project will be due during the last week of classes.

The course will be graded on the standard OSU grading scale.

Course Outline

The course is split into seven topics, each of which pairs an astronomy topic with a data analysis method and contemporary tools used for the data analysis. Each of these topics will be covered in two weeks, with approximately equal time spent on the astronomy and analysis methods.

Topic 1: Solar System
Astronomy: planets, moons, asteroids, and the Sun
Analysis: basic statistics, such as mean, median, standard deviation, distributions
Tools: python basics, including syntax, functions, tables, and the astropy and numpy packages
Assignment: compute properties of various solar system bodies

Topic 2: Stars
Astronomy: main sequence, hydrostatic equilibrium, nucleosynthesis, physical properties

Analysis: uncertainties, model regression
Tools: visualization methods, especially the python matplotlib package
Assignment: create HR diagrams from GAIA data and compare to models

Topic 3: Exoplanets
Astronomy: discovery techniques, demographics of exoplanet systems
Analysis: time series analysis
Tools: python pandas package
Assignment: identify planet transits in Kepler data and estimate properties of planet systems

Topic 4: Milky Way
Astronomy: distribution of stars, shape of the Galaxy
Analysis: database structure, query design, data mining
Tools: data retrieval and database queries
Assignment: distribution of stars in the Galaxy with SDSS data, implications of uncertainties

Topic 5: Galaxies
Astronomy: morphological types, sizes, distances, stellar populations
Analysis: classification with machine learning
Tools: python skikit-learn package
Assignment: identify different classes of galaxies in SDSS images with machine learning

Topic 6: Dark Matter
Astronomy: velocities from galaxy spectra, galaxy rotation curves, galaxy clusters
Analysis: model development and testing
Tools: python scipy package
Assignment: fit galaxy rotation curves, measure cluster galaxy velocity distributions with SDSS

Topic 7: Cosmology
Astronomy: expansion of the universe, Type 1a SN, Hubble diagram, dark energy
Analysis: model development and testing
Tools: python scipy package
Assignment: determine the expansion rate and acceleration of the universe

Academic Misconduct

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct http://studentlife.osu.edu/csc/.

Students with Disabilities

Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; http://www.ods.ohio-state.edu/.

General Education Rationale for Astronomy 1221
Astronomy Data Analysis

Astronomy 1221 is an overview of data analysis in astronomy. It is a General Education (GE) Physical Science course in the Natural Science category that is intended for BS and BA students. Astronomy 1221 is not intended to be a comprehensive survey of astronomy, nor of data analysis, but will instead cover a limited number of topics in astronomy and the analysis of large datasets to illustrate general principles of physical science and the scientific method. While the course is numbered at the 1000-level, it is our experience that astronomy GE courses are taken by students at all ranks.

The **expected learning outcomes** for GE courses in the Natural Science category are as follows:

1. Students understand the basic facts, principles, theories, and methods of modern science.
2. Students understand key events in the development of science and recognize that science is an evolving body of knowledge.
3. Students describe the inter-dependence of scientific and technological developments.
4. Students recognize social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world.

We designed Astronomy 1221 based on **course-specific learning objectives**, and will use assignments to achieve these objectives. The course-specific objectives and their mapping to the GE expected learning outcomes are as follows:

(a) Students will understand how astronomical data lead to conclusions about the physical nature of celestial objects and the universe. Students will understand how measurement uncertainties affect the ability to discover new phenomena and to infer physical properties. This will include analysis of data in: (1) “exploration mode” using visualization and classification to discover phenomena and identify patterns; (2) “model fitting and testing mode” using quantitative methods to infer values and uncertainties of model parameters and to test the validity of models. This maps to GE learning outcomes #1 and #2.
(b) Students will understand the basic tools of astronomical data collection and the technology that underpins them. This maps to GE learning outcomes #1 and #3.
(c) Students will develop the skills needed to use the Python programming language for data visualization and manipulation, for numerical modeling, and for numerical problem solving. Python has rapidly become the "lingua franca" for much astronomical data analysis and numerical computation, so these skills will be of great value to students in future courses in astronomy or other classes that involve numerical problem solving or analysis of data sets. This maps to GE learning outcomes #1 and #4.

We next describe how each GE expected learning outcome (ELO) is met by the main components of the course, specifically the course objectives, the course topics, and the course assignments. We also describe why this course should be eligible for both BA and BS students,

and why the prerequisites provide an appropriate level of preparation.

Q1: How is each individual GE ELO met by the course objectives?

- ELO1: This is met by course objectives (a), (b), and (c). Objective (a) is relevant because students will learn basic facts, principles, and theories of modern science as they learn about the physical nature of celestial objects and the universe. They will also learn the methods of modern science through data analysis. Objective (b) is relevant because the tools of data collection and technology are connected to methods of modern science. Objective (c) is also relevant because it includes data analysis tools, such as the python programming language, for astronomical data analysis.
- ELO2: This is met by course objective (a). Objective (a) will demonstrate how new data have led to the development of new theories and new understanding of the physical nature of celestial objects and the universe.
- ELO3: This is met by course objective (b). Objective (b) will demonstrate how new analysis methods and new technologies have lead to new scientific understanding.
- ELO4: This is met by course objective (c). Objective (c) will demonstrate how new technologies have lead to new discoveries.

Q2: How is each individual GE ELO met by the course topics?

The course consists of seven astronomical topics, each of which is paired with analysis methods and analysis tools, as well as an assignment. These topics are:

Topic 1: Solar System
Astronomy: planets, moons, asteroids, and the Sun
Analysis: basic statistics, such as mean, median, standard deviation, distributions
Tools: python basics, including syntax, functions, tables, and the astropy and numpy packages
Assignment: compute properties of solar system bodies

Topic 2: Stars
Astronomy: main sequence, hydrostatic equilibrium, nucleosynthesis, physical properties
Analysis: uncertainties, model regression
Tools: visualization methods, especially the python matplotlib package, file I/O
Assignment: create HR diagrams from GAIA data and compare to models

Topic 3: Exoplanets
Astronomy: discovery techniques, demographics of exoplanet systems
Analysis: time series analysis
Tools: python pandas package
Assignment: identify planet transits in Kepler data and estimate properties of planet systems

Topic 4: Milky Way
Astronomy: distribution of stars, shape of the Galaxy
Analysis: database structure, query design, data mining
Tools: data retrieval and database queries

Assignment: distribution of stars in the Galaxy with SDSS data, implications of uncertainties

Topic 5: Galaxies
Astronomy: morphological types, sizes, distances, stellar populations
Analysis: classification with machine learning
Tools: python skikit-learn package
Assignment: identify different classes of galaxies in SDSS images with machine learning

Topic 6: Dark Matter
Astronomy: velocities from galaxy spectra, galaxy rotation curves, galaxy clusters
Analysis: model development and testing
Tools: python scipy package
Assignment: fit galaxy rotation curves, measure cluster galaxy velocity distributions with SDSS

Topic 7: Cosmology
Astronomy: expansion of the universe, Type 1a SN, Hubble diagram, dark energy
Analysis: model development and testing
Tools: python scipy package
Assignment: determine the Hubble constant, demonstrate evidence for cosmic acceleration

These topics map to the ELOs as follows:

- ELO1: All of the topics will cover the basic facts, principles, theories, and methods of modern science.
- ELO2: Each topic will include the history of discovery to demonstrate that science is an evolving body of knowledge. Particularly noteworthy topics in this regard are exoplanets, dark matter, and dark energy (cosmology).
- ELO3: Each astronomy topic is combined with an analysis topic that will demonstrate the inter-dependence of scientific and technological developments.
- ELO4: The historical overview of each topic will include a description of the philosophical implications of the discoveries.

Q3: How is each individual GE ELO met by the course assignments?

- ELO1: The assignments will all involve the application of the methods of modern science to further student understanding of basic facts, principles, and theories.
- ELO2: The assignments will foster further understanding of key developments and discoveries
- ELO3: The assignments will demonstrate how new technological developments have let to new scientific discoveries.
- ELO4: The assignments will provide further opportunity to understand the philosophical implications of scientific discoveries.

Q4: Why should this course be eligible to both BA and BS students?

This course meets at least two of the guidelines provided by the ASCC Natural and

Mathematical Sciences Panel for courses eligible for both BA and BS students. The main one is that this course involves intensive data collection and analysis activities. Every course topic includes substantial material on analysis methods and python programming, and all of the assignments will require computations. The other guideline satisfied by the course is that we expect many astronomy and astrophysics majors will take the course, although we only plan to recommend and not require it. We plan to recommend that majors take this course before they get involved in undergraduate research projects, although will not require it because the astronomy topics will be covered at an inappropriately low level for majors.

Q5: How do the prerequisites provide an appropriate level of preparation for the course?

The assignments have been designed so that only basic mathematical knowledge is required. No previous astronomy coursework is required.

General Education Assessment Plan for Astronomy 1221
Astronomy Data Analysis

Astronomy 1221 is an overview of the analysis of big data in astronomy. It is a General Education (GE) Physical Science course in the Natural Science category that is intended for BA and BS students. Astronomy 1221 is not intended to be a comprehensive survey of astronomy, nor of data analysis, but will instead cover a limited number of topics in astronomy and the analysis of large datasets to illustrate general principles of physical science and the scientific method.

We will employ rubrics to assess student understanding with programming assignments. These will take the form of embedded textual and numerical assignments that will be included in all assignments every time the course is offered. The text questions will correspond to multiple-choice and short answer questions that will be used to evaluate understanding of basic astronomical topics. These will include questions that are also asked as part of the assessment plans for Astronomy 1101, 1140, and 1144. The numerical questions will be basic, numerical results that demonstrate mastery of key concepts, and will be a useful gauge of student performance in these areas over time.

Examples of these questions are included below. The final set of questions will be determined when the course is offered for the first time.

We will also use indirect assessment through narrative evaluations to complement the student evaluation of instruction. These will ask about the GE learning objectives and for feedback on course components (lectures, assignments). This feedback will be used to refine the course content.

GE Expected Learning Outcomes	Methods of Assessment	Level of student achievement expected for the GE ELO	What is the process that will be used to review the data and potentially change the course to improve student learning of the GE ELOs?
ELO1. Students understand the basic facts, principles, theories and methods of modern science.	Embedded multiple choice, short-answer text, and numerical questions on assignments. The multiple choice questions are also used in Astronomy 1101, 1140, and 1144	>75% of students will answer questions correctly	
ELO2. Students understand key events in the development of science and recognize that science is an evolving body of knowledge.	Embedded multiple-choice questions in assignments that are also used in Astronomy 1101, 1140, and 1144	>75% of students will answer questions correctly	
ELO3 Students describe the inter-dependence of scientific and technological developments.	Embedded short-answer text questions on assignments	>75% of students will answer questions correctly	
ELO4 Students recognize social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world.	Embedded short-answer text questions on assignments	>75% of students will answer questions correctly	

Sample questions:

Topic 3: Exoplanets

1. What method does the *Kepler* satellite use to identify exoplanets? (ELO1)
2. How does the number of exoplanets discovered by Kepler compare to other techniques? (ELO2, ELO3)
3. Search for a period transit signal in the light curve for the star in the datafile, identify the period of the transit event, and determine the distance of the transiting object from the star. (ELO1,3)
4. What are the prospects for life on this object? (ELO4)

Topic 7: Cosmology

1. Use data for the distances and velocities of galaxies to determine the local expansion rate of the universe. (ELO1, ELO2)
2. Use data for the distances and luminosities of supernovae create a figure of the distance-redshift relation. (ELO21, ELO2)
3. Describe the origin of the data necessary to measure the distance-redshift relation with supernovae. (ELO3)
4. What are the implications of this discovery for the fate of the universe? (ELO4)

Date: Wed, 15 Nov 2017 21:01:47 -0500
From: "Parthasarathy, Srinivasan" <srini@cse.ohio-state.edu>
To: "Martini, Paul" <martini.10@osu.edu>,
"Hans, Christopher" <hans@stat.osu.edu>
Cc: "Sivilotti, Paul" <paolo@cse.ohio-state.edu>
Subject: RE: Concurrence Request from Astronomy

Dear Paul:

Concurrence requests for the data analytics major go through the respective departmental curriculum committees that direct the program (CSE and Statistics). I am forwarding your request to the CSE curriculum chair (Paul Sivilloti).

Cheers,
Srini

From: Martini, Paul
Sent: Wednesday, November 15, 2017 7:07 PM
To: Hans, Christopher; Parthasarathy, Srinivasan
Subject: Concurrence Request from Astronomy

Dear Chris Hans, Srini Parthasarathy,

The Astronomy Department has developed and proposed a new GE course called 'Astronomy Data Analysis with Python.' Our aims with this course are to engage a larger number of potential astronomy & astrophysics majors during their first year, as well as attract students who want to satisfy their GE requirement with an astronomy course that is more computational than our other astronomy GE options.

This proposal was approved by the NMS Panel of the ASC Curriculum Committee and then reviewed by OAA, and OAA said they would like us to seek concurrence from the Data Analytics major.

As the course teaches astronomy topics, and how astronomical data are used to draw conclusions, I do not see a conflict with any of the courses offered as part of the Data Analytics major, but I certainly may have missed something. And my hope is that this course would inspire greater interest in data analysis and in your major program -- of course in addition to greater interest in the astronomy & astrophysics major.

Would you please look over the attached syllabus and let me know if you concur? If I do not hear anything from you within two weeks (Nov 29), I was told by OAA that I can assume you concur.

Thank you for your consideration.

Paul

--
Paul Martini
Professor of Astronomy
The Ohio State University

Date: Wed, 22 Nov 2017 13:35:31 -0500
From: "Lee, Yoonkyung" <yklee@stat.osu.edu>
To: "Martini, Paul" <martini.10@osu.edu>
Subject: RE: Concurrence Request from Astronomy
Parts/Attachments:
1 Shown ~421 lines Text (charset: Windows-1252)
2 OK 3.7 KB Image, "osu-emailsig.png"

Dear Paul,
The curriculum committee in Statistics reviewed the syllabus of the proposed course, Astronomy Data Analysis with Python. We found the course to be very unique and modern in covering astronomy topics from astronomical data analysis and computational viewpoints. We don't see any conflict with our courses in Statistics and strongly support the offering of this exciting new course.

Best,

Yoon
On behalf of the Curriculum Committee

--
Yoonkyung Lee
Professor of Statistics
Professor of Computer Science and Engineering (by courtesy)
The Ohio State University

From: Hans, Christopher
Sent: Thursday, November 16, 2017 10:06 AM
To: Martini, Paul
Cc: Parthasarathy, Srinivasan; Lee, Yoonkyung; MacEachern, Steven
Subject: Re: Concurrence Request from Astronomy

Dear Paul,
I have cc'd our curriculum committee chair (Yoon Lee) and department chair; they will be able to coordinate reviewing the proposing within Statistics.

Best regards,
Chris Hans

[IMAGE]

Christopher M. Hans, Ph.D.
Associate Professor Co-Director, Data Analytics Major
College of Arts and Sciences Department of Statistics
614-292-7157
www.stat.osu.edu/~hans [www.stat.osu.edu]

Major in Data Analytics:
data-analytics.osu.edu [data-analytics.osu.edu]

> On Nov 16, 2017, at 12:48 AM, Martini, Paul <martini.10@osu.edu>

wrote:

Dear Paul,

Attached is the syllabus, and my original email to Chris and Srini (below) has more information about Astronomy's motivation for this course. This may provide some helpful context.

Thank you for your consideration, Paul

--
Paul Martini
Professor of Astronomy
The Ohio State University

Date: Mon, 12 Feb 2018 17:42:42 -0500
From: "Sivilotti, Paul" <paolo@cse.ohio-state.edu>
To: "Martini, Paul" <martini.10@osu.edu>
Subject: RE: Concurrence Request from Astronomy

Hi Paul--

Thanks for this reminder... We did discuss this your request in our curriculum committee, but then it slipped out of my inbox, and off my radar. Apologies for my delay in responding.

The inclusion of "Python" in the title of the course is really a major sticking point for the committee. Since Python is such a popular intro programming language, the concern is that such a course would be (and would certainly appear to be, to students) an introduction to *both* programming and to the application domain. Removing the programming language from the course title--rather than reducing information--seems preferable from a "truth in advertising" perspective.

Other options (cross-listing, pre-reqs, etc) do remain, but they come with various consequences as you point out. Perhaps there are other compromise solutions that haven't occurred to me, but the inclusion of Python in the course title itself is a bright line.

Best wishes,
--paul

-----Original Message-----
From: Martini, Paul
Sent: Monday, February 12, 2018 5:09 PM
To: Sivilotti, Paul
Subject: RE: Concurrence Request from Astronomy

Hi Paul,

Did you get a chance to further discuss our request with your committee?

Thank you,
Paul

--
Paul Martini
Professor of Astronomy
The Ohio State University

---------- Forwarded message ----------
Date: Fri, 19 Jan 2018 11:21:06 -0500 (EST)
From: Paul Martini <martini.10@osu.edu>
To: "Sivilotti, Paul" <paolo@cse.ohio-state.edu>
Subject: RE: Concurrence Request from Astronomy

Hi Paul,

Yes, another 1-2 weeks is fine.

Thanks,
Paul

--
Paul Martini
Professor of Astronomy
The Ohio State University

On Thu, 18 Jan 2018, Sivilotti, Paul wrote:

> Hi Paul--
>
> Sorry for not getting back to you earlier. We haven't had a
> curriculum meeting here yet to discuss your note... Can you give me
> another week-and-a-half to get your request (re)considered by that committee?
>
> If there is more urgency, I can circulate your note by email. But I
> suspect it would get more substantive discussion in an actual meeting.
>
> --paul
>
> -----Original Message-----
> From: Martini, Paul
> Sent: Thursday, January 18, 2018 8:40 AM
> To: Sivilotti, Paul
> Cc: Weinberg, David; Terndrup, Don
> Subject: RE: Concurrence Request from Astronomy
>
>
> Dear Paul,
>
> I'm writing to check in to see if you (and CSE) have had a chance to
> ponder my email from Dec 11 (appended below).
>
> Thank you,
> Paul
>
> --
> Paul Martini
> Professor of Astronomy
> The Ohio State University
>
> ---------- Forwarded message ----------
> Date: Mon, 11 Dec 2017 14:02:53 -0500 (EST)
> From: Paul Martini <martini.10@osu.edu>
> To: "Sivilotti, Paul" <paolo@cse.ohio-state.edu>
> Cc: David H. Weinberg <weinberg.21@osu.edu>, Don Terndrup
> <terndrup.1@osu.edu>
> Subject: RE: Concurrence Request from Astronomy
>
>
> Dear Paul,
>
> We elected to offer this course, and to offer it in Python, because
> Python has emerged as a "lingua franca" for astronomy modeling and
> data analysis over the past 5 years, with a wide range of utilities
> and applications being developed by astronomers around the world. The
> learning curve for Python is also relatively shallow, so students
> with basic mathematical ability can go from no experience to
> analyzing data, fitting models, and making plots in the course of a

> semester. Thus, it is possible to offer a GE-level course that
> teaches students astronomy through hands-on numerical experience with
> data, which would not have been conceivable even a few years ago.
> Although this is a GE-level class, we hope that a number of our
> majors will elect to take it, giving them the skills they need to start doing astronomy research with
faculty in subsequent years.
>
> Of the options you suggest, #1 would cut down drastically on the
> number and breadth of students who might consider the course, and #2
> would give the course a focus on programming methods that really
> isn't its goal. Since CSE is willing to concur if we remove the word
> 'Python,' we would change the name to
>
> Astronomy Data Analysis
>
> We would do so with reluctance because this change seems to us to
> only reduce the information to students looking through the course
> catalog, and to do so only for purposes of turf-division. We regard
> the title
>
> Astronomy Data Analysis with Python
>
> as more informative and more accurate; we will be teaching students
> astronomical concepts and methods of analyzing astronomical data using
> a specific set of tools that have proven to be widely useful in the
> field and offer students a rapid entry to an interestingly high level
> of scientific analysis.
>
> We therefore ask that you reconsider your objection to our title.
> However, if you maintain it, then we will change the title to the
> less informative one given above.
>
> We're glad to hear that you are planning to introduce a Python
> programming course in CSE. We can readily imagine that many students
> who take the Astronomy class would emerge enthusiastic enough about
> Python that they want to learn it more systematically and
> comprehensively, and they will be glad to have a course to go to.
>
> Thank you for your (re)consideration, Paul
>
> Paul Martini, Curriculum Committee Chair Don Terndrup, Director of
> Undergraduate Studies David Weinberg, Department Chair
>
>
> PS Apologies for taking so long to respond to your email. I dropped
> this ball during an end-of-semester juggling frenzy.
>
>
>

Date: Fri, 17 Nov 2017 09:45:17 -0500
From: "Sivilotti, Paul" <paolo@cse.ohio-state.edu>
To: "Martini, Paul" <martini.10@osu.edu>
Subject: RE: Concurrence Request from Astronomy

Hi Paul--

The CSE curriculum committee reviewed the syllabus for Astronomy 1221 -- Astronomy Data Analysis with Python. It looks like an interesting course that could benefit many students.

However, we are concerned about the degree to which the course presents itself as an intro to programming in Python. While the course is clearly more than just programming (the context is obviously important), it is a matter of degree--and of appearance. Intro programming courses are a core component of our curricular offerings, including intro programming in specific applied contexts (eg a variety of offerings tailored to business, media, science, engineering, etc) and in specific languages (eg C++, Java, Matlab, Processing, etc).

I have three alternatives to suggest as possible ways forward:

1. Modify the pre-requisites of Astronomy 1221 to require a CSE intro programming course.

2. Cross-list the course with CSE.

3. Modify the title to remove "Python". A programming and programming-language-neutral term like "computational methods" or "digital science" or something similar would be fine.

Of these, the third seems easiest. But I'm happy to assist if you would prefer either of the other options. For example, we are currently rolling out an intro-to-Python pilot offering which might be particularly appealing for option #1.

Best wishes,
--paul

-----Original Message-----
From: Martini, Paul
Sent: Thursday, November 16, 2017 12:49 AM
To: Sivilotti, Paul
Cc: Parthasarathy, Srinivasan; Hans, Christopher
Subject: Re: Concurrence Request from Astronomy

Dear Paul,

Attached is the syllabus, and my original email to Chris and Srini (below) has more information about Astronomy's motivation for this course. This may provide some helpful context.

Thank you for your consideration,
Paul

--
Paul Martini
Professor of Astronomy
The Ohio State University

On Thu, 16 Nov 2017, Sivilotti, Paul wrote:

> Hi Paul—
> I’m happy to take a look. Can you send me the syllabus for the
> course? We
> (CSE) happen to have a curriculum committee meeting this morning
> (thurs) at 10, so if can get the syllabus to me before that, I will
> have a quick response for you.
>

> Regards,
> —paul
>
> --paul
>
> On Nov 15, 2017, at 9:01 PM, Parthasarathy, Srinivasan
> <srini@cse.ohio-state.edu> wrote:
>
> Dear Paul:
>
> Concurrence requests for the data analytics major go through the
> respective departmental curriculum committees that direct the
> program (CSE and Statistics). I am forwarding your request to
> the CSE curriculum chair (Paul Sivilloti).
>
> Cheers,
> Srini
>
>
>
>
>
> _____
> From: Martini, Paul
> Sent: Wednesday, November 15, 2017 7:07 PM
> To: Hans, Christopher; Parthasarathy, Srinivasan
> Subject: Concurrence Request from Astronomy
>
> Dear Chris Hans, Srini Parthasarathy,
>
> The Astronomy Department has developed and proposed a new GE
> course called 'Astronomy Data Analysis with Python.' Our aims with
> this course are to engage a larger number of potential astronomy &
> astrophysics majors during their first year, as well as attract
> students who want to satisfy their GE requirement with an
> astronomy course that is more computational than our other
> astronomy GE options.
>
> This proposal was approved by the NMS Panel of the ASC Curriculum
> Committee and then reviewed by OAA, and OAA said they would like
> us to seek concurrence from the Data Analytics major.
>
> As the course teaches astronomy topics, and how astronomical data
> are used to draw conclusions, I do not see a conflict with any of
> the courses offered as part of the Data Analytics major, but I
> certainly may have missed something. And my hope is that this
> course would inspire greater interest in data analysis and in your
> major program -- of course in addition to greater interest in the
> astronomy & astrophysics major.
>
> Would you please look over the attached syllabus and let me know
> if you concur? If I do not hear anything from you within two weeks
> (Nov 29), I was told by OAA that I can assume you concur.
>
> Thank you for your consideration.
>
> Paul
>

> --
> Paul Martini
> Professor of Astronomy
> The Ohio State University
>
>
>