Proposal for a New Course

NOTE: (1) All gray text boxes must be completed (even if you just put N/A into them), otherwise the committee must consider the form incomplete.
NOTE: (2) If the new course is to be accepted as fulfilling General Education requirements, a separate approval must be done through the General Education Committee.

Contact person George Chartas  Email address chartasg@cofc.edu Phone 3-3609

1. Department: Physics and Astronomy

2. Course number and title: ASTR.210: Black Holes in the Universe
   Number of Credits: 3    Total hrs/week: 3
   Lecture: ☒   Lab: ☐   Recitation: ☐   Seminar: ☐
   For Independent study courses:
      Research: ☐   Field experience: ☐
      Clinical Practice: ☐   Internship: ☐
      Practicum: ☐   Independent Course Work: ☐

3. Semester and year when course will first be offered:
   Spring 2013

4. Catalog Description (please limit to 50 words):
   Properties of black holes and observations of objects that might harbor them. Topics include Einstein's special and general relativity, stellar evolution, black hole detection, accretion and outflows, gravitational waves, the Hawking's effect, singularities and the possibility of creating mini black holes in the laboratory. For non-science majors.

5. CIP Code: 40.02 (This code must be determined for new courses. The codes can be found at http://nces.ed.gov/ipeds/cipcode/. If you are not sure what code to use, please consult with the Institutional Research).

6. Check if appropriate: ☐
   This course will be cross listed with:
   Rationale for cross listing:
   Please attach letters of support from the chairs of each department indicating that the department has discussed the proposal and supports it.

7. a) Could another department or program also be a logical originator of this course (i.e. History of American Education could originate in both the Teacher Education and the History departments)? If yes, what department/program? Please contact the department chair/program director and request a note or email that they are aware of the proposed new course and include that note with the proposal.
   No
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b) Please explain overlap with any existing courses.
   This course expands upon selected topics from ASTR.130. It is taught with a minimum of mathematical knowledge; students wishing a more mathematical presentation of the material should also take ASTR.410.

8. Prerequisites (or other restrictions):
   Prerequisites: MATH 101.
   Corequisites: none.

9. Rationale/justification for course (consider the following issues):
   a) What are the goals and objectives of the course?
      The goals and objectives of Astro 210 are to provide undergraduates students with an introduction to some of the predicted strange properties of black holes and describe observations of objects that we think harbor them. Students will learn about Einstein's views of the nature of space, time and gravity without the need of advanced mathematics.

   b) How does the course support the mission statement of the department and the organizing principles of the major?
      This course presents astronomy topics that could be used by high school teachers or planetarium directors, and is thus valuable to B.A. students in Astronomy or Astronomy minors.

10. a) For courses in the major, how does the course enhance the beginning, middle, or end of the major?
    This course is taught at a level that supports students in the middle of the Astronomy B.A.

    b) For courses used by non-majors, how does the course support the liberal arts tradition including linkages with other disciplines:
    The course recognizes that the important scientific topic of black holes is also a popular science topic. Exploring this topic at a non-mathematical level allows the subject matter to be spread to a broader audience in the liberal arts tradition.

11. Method of teaching:
    Lecture, working together in groups.

12. a) Address potential enrollment pattern shifts in the department or college-wide related to the offering of this course:
    This general interest course is expected to increase elective enrollment in Astronomy. It should also increase enrollment in the B.A. Astronomy program and in the Astronomy minor.

    b) Address potential shifts in staffing of the department as it relates to the offering of this course:
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none.

c) Frequency of offering:
   each fall: □ each spring: □
   every two years: ☒ every three years: □
   other □ (Explain):

13. Requirements for additional resources made necessary by this course:

   a) Staff:
      This course replaces a special topics course in Cosmology that was previously
      offered in its place.

   b) Budget:
      none needed.

   c) Library:
      none.

14. Is this course to be added to the Degree Requirements of a Major, Minor, Concentration or List
    of Approved Electives?
   a) ☒ yes □ no

   b) If yes, complete the Change Degree Requirements form(s) and list the name(s) of the major,
      minor, concentration and/or list of approved electives here:
      B.A. Astronomy
      Minor Astronomy

15. Paste syllabus, reading lists, or any additional documentation that can help the committee
    evaluate this proposal (a syllabus is mandatory).
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16. Signature of Department Chair or Program Director:

______________________________________________________________
Date: ____________________________

17. Signature of Dean of School:

______________________________________________________________
Date: ____________________________

18. Signature of Provost:

______________________________________________________________
Date: ____________________________

19. Signature of Curriculum Committee Chair

______________________________________________________________
Date: ____________________________

20. Signature of Faculty Senate Secretary:

______________________________________________________________
Date Approved by Senate: ____________________________

Completed form should be sent by the Faculty Senate Secretary to the Registrar. After implementation, information concerning the passed course and program changes will be provided by the Registrar to all faculty and staff on campus.
Astronomy 210: Black Holes in the Universe

Lecture: Monday, Wednesday & Friday
Location: Rita Hollings Science Center, room 126
Time: MWF 2:00pm - 2:50pm

Instructor: Dr. George Chartas
Office: 129 RHSC
Office hours: MWF ()-() pm
Phone: (843) 953-3609
Email: chartasg@cofc.edu

A preliminary outline of the course can be found at the SCHEDULE website. Some of this material is subject to change and this site will be constantly up-dated so please check it before each class.

Syllabus

Required materials:
The required textbook for the course is Gravity’s Fatal Attraction, Black Holes in the Universe Second Edition by Mitchell Begelman and Martin Rees.

Recommended textbook for the course is Black Holes and Time Warps, Einstein’s Outrageous Legacy by Kip S. Thorne
**Course Objectives:**

Ever wonder what it would be like to cross the event horizon of a black hole, or whether time travel was possible? Find out how you can travel in a round trip close to the speed of light to find out that your friend has aged when you return. Will the Large Hadron Collider create mini black holes and is it safe? Learn about how black holes drag space along as they rotate and do so with “no hair”.

This course will cover the strange predicted properties of black holes and describe observations of objects that we think harbor them. Here is a brief overview of the topics that will be covered. A more detailed description is presented on my schedule website:

- Einstein's theory of special relativity (length contraction, time dilation)
- Einstein’s theory of general relativity (equivalence principle, spacetime, predicting black holes)
- Stellar Evolution and the fate of stars (Brown Dwarfs, White Dwarfs, Neutron stars, Black holes)
- Detection of stellar mass black holes
- Accretion onto black holes
- Galaxies and their Nuclei
- Dark Matter and how to detect it.
- Quasars and Jets
- Gamma Ray Bursts, The most powerful explosions in the Universe
- The Black hole in the center of the Milky Way
- Gravitational Waves
- Feedback between black holes and their environments
- Miniholes and the Hawking Effect
- Inside Black Holes (Singularities)
- Black Holes in the Laboratory?

I recommend that you review the material before it is presented in class. This will help you to better understand the concepts and enjoy the class. I expect your active participation in the class.
SPECIFICS

CREDIT: This is a three-credit course.

PREREQUISITES: This course is designed for non-science majors. Advanced mathematics is not required; only high-school level math will be used occasionally.

PRESENTATIONS: Every student will be expected to contribute to a 15-minute presentation on a topic related to material covered in the course. You will work in groups of three to prepare and present the research talk.

The presentation may be in PowerPoint, keynote, overhead or blackboard. It should include a list of references and each student should present a portion of the talk.

There will be three dates near the end of the semester allocated to these research presentations.

Midterm Exams and Quizzes:

There will be 2 midterm exams over the semester. Several quizzes will be given during lectures. The quizzes will be based on material already presented in lectures. There will be a final exam that will cover most of the material presented in the lectures.
Grades

Your final grade will be calculated as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quizzes</td>
<td>15%</td>
</tr>
<tr>
<td>Presentation and Participation</td>
<td>20%</td>
</tr>
<tr>
<td>Midterms</td>
<td>40%</td>
</tr>
<tr>
<td>Final</td>
<td>25%</td>
</tr>
</tbody>
</table>

Your number grade will be converted into a letter grade as follows.

<table>
<thead>
<tr>
<th>Percentage Range</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;85%</td>
<td>A</td>
</tr>
<tr>
<td>80-84%</td>
<td>A-</td>
</tr>
<tr>
<td>76-80%</td>
<td>B+</td>
</tr>
<tr>
<td>72-76%</td>
<td>B</td>
</tr>
<tr>
<td>68-72%</td>
<td>B-</td>
</tr>
<tr>
<td>64-68%</td>
<td>C+</td>
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<tr>
<td>60-64%</td>
<td>C</td>
</tr>
<tr>
<td>56-60%</td>
<td>C-</td>
</tr>
<tr>
<td>52-56%</td>
<td>D+</td>
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<tr>
<td>48-52%</td>
<td>D</td>
</tr>
<tr>
<td>44-48%</td>
<td>D-</td>
</tr>
<tr>
<td>&lt;44%</td>
<td>F</td>
</tr>
</tbody>
</table>

Special Needs

If you have any special needs or disabilities that might require special arrangements to be made for any aspect of this course, please let me know at the beginning of the semester or as soon as you become aware of them.

Class Policies:

Cellular technology: Please respect your classmates and keep your cellular devices off.
**Cheating:**

Violations of the College of Charleston Honor Code (including cheating or attempted cheating) will be referred to the Office of Student Affairs for adjudication. Examples of cheating include copying test or quiz answers, using cellular technology to communicate information during a test or quiz, copying homework answers verbatim from an external source.