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 Jon Hakkila & Cassandra Runyon Email address hakkilaj@cofc.edu & runyonc@cofc.edu Phone 3-6387 & 3-8279

1. Department: Physics and Astronomy & Geology and Environmental Geosciences

2. Course number and title: ASTR.260: NASA Space Mission Design
   Number of Credits: 2   Total hrs/week: 2

   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:
   Fall 2011

4. Catalog Description (please limit to 50 words):
   Students work on teams with engineering students at another university to design unmanned NASA satellite missions. Student teams interactively participate through presentations, assigned readings, on-line discussions, classroom exercises and dynamic activities, and compete for best mission with final projects being evaluated by a panel of NASA experts.

5. CIP Code: 40.0203/40.0699 (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: GEOL.260 and PHYS.260

   Rationale for cross listing: This course is based in the interdisciplinary fields of planetary geology and astronomy, which require knowledge from both Geology and Physics/Astronomy departments. Team success depends on having students from both disciplines working together and sharing their knowledge and information among their team.

   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.
Proposal for a New Course

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.

Yes, Geology. Both Departments are originating this course together.

b) Please explain overlap with any existing courses.

8. Prerequisites (or other restrictions):
   Prerequisites: (ASTR 129 / ASTR 130) or (ASTR 206) or (HONS 390 (Astronomy)) or (GEOL 206) or (HONS 395 Geology) or (PHYS 101 / PHYS 102) or (PHYS 111 / PHYS 112) or (HONS 157 / 158) or permission of instructor.
   Corequisites: ASTR.260L/GEOL.260L/PHYS.260L or ASTR.460L/GEOL.460L/PHYS.460L

9. Rationale/justification for course (consider the following issues):

   a) What are the goals and objectives of the course?
      Students will learn how to write a research proposal.
      Students will learn how to communicate with other scientists and engineers.
      Students will learn how to work together as a team, while competing on a large project.
      Students will learn how to apply their knowledge of planetary science, geology, astronomy, and/or physics to the solution of a large, complex problem.
      Students will learn how to present and defend their findings in front of a panel of international experts.

   b) How does the course support the mission statement of the department and the organizing principles of the major?
      One common goal of the Astronomy, Physics, and Geology degrees is to for students to conduct hands-on research. This course teaches undergraduates how to conduct research, write a full-scale mission proposal with their peers that is evaluated by outside professionals. This course "brings the real world into the classroom".

10. a) For courses in the major, how does the course enhance the beginning, middle, or end of the major?
     ASTR.260/GEOL.260 counts towards a BA in astronomy, a minor in Astronomy. a BA in physics. a BA in Geology, and a BS in Geology. As an interdisciplinary course, it enhances the beginning and middle of the majors.

     b) For courses used by non-majors, how does the course support the liberal arts tradition including linkages with other disciplines:
        This cross-disciplinary nature of this course, cutting as it does across science and engineering boundaries, university boundaries, and even state and international
Proposal for a New Course
boundaries, makes it a liberal arts and sciences course in the grand tradition.

11. Method of teaching:
Lecture, teamwork (small and large groups), team presentations, technical writing (team proposal), peer evaluations and panel evaluation by professional scientists and engineers.

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 and Geology. It should also increase enrollment in the B.A. Astronomy program.

b) Address potential shifts in staffing of the department as it relates to the offering of this course:
Due to the external funding described below, no staffing changes are forseen in the next three years.

c) Frequency of offering:
- each fall: ☐
- each spring: ☐
- every two years: ☐
- every three years: ☐
- other ☒ (Explain): every semester; the course is ideally a two-semester course spanning an academic year, although it can be taken as a single-semester course.
* Note: this course can be taken multiple times, as each offering of the course is different.

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

a) Staff:
The course has been team taught for three semesters by Cass Runyon in Geology as part of load and by Jon Hakkila in Physics as an unpaid overload. However, a NASA grant subaward to the College of Charleston includes money for some overload release to support this course for the next three years. No additional staffing budget is requested at this time.

b) Budget:
The aforementioned NASA grant subaward has included $7500 for travel last year and $20000 for travel this year, with additional funding anticipated during the next two academic years. No additional budget is requested at this time.

c) Library:

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

This form was approved by FCC on 8/17/2010 and replaces all others. p. 3
Proposal for a New Course

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
   Minor Physics
   B.A. Physics
   Minor Geology
   B.A. Geology
   B.S. Geology

15. Paste syllabus, reading lists, or any additional documentation that can help the committee evaluate this proposal (a syllabus is mandatory).
Proposal for a New Course

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.
INSTRUCTORS: Dr. Cassandra Runyon, College of Charleston  
Dr. Jon Hakkila, College of Charleston

CONTACT INFORMATION:
Email: runyonc@cofc.edu  
hakkilaj@cofc.edu

2 credits (2 hours / week)

MEETING LOCATION
NSCB (New Science Center Building) – Room 200

EXTRA MEETINGS: Extra team meetings shall be scheduled throughout the semester on an as-needed basis. Such meetings can be scheduled in NSCB 200 and other rooms in NSCB or other areas as designated by the team.

TARGET AUDIENCE:
Undergraduate science majors / minors interested in working with NASA mission data

Prerequisites: (ASTR 129 / ASTR 130) or (ASTR 206) or (HONS 390 (Astronomy)) or (PHYS 101 / PHYS 102) or (PHYS 111 / PHYS 112) or (HONS 157 / 158) or (GEOL 206) or (HONS 395 Geology) or permission of instructors
Corequisite: GEOL.260L / ASTR.260L / PHYS.260L or GEOL.460L / ASTR.460L / PHYS.460L

TEXTBOOK:
We will be using NASA Discovery Announcement of Opportunity (2010) and other NASA and space related resources from the World Wide Web and additional databases to support course discussions

FOCUS OF THE COURSE:
The NASA Space Mission Design course is designed for students who want to understand more about how we explore the solar system. Students will apply scientific theory to age-old questions about how the solar system formed and evolved. As teams, they will work together to learn about how scientists and engineers gather in-situ data from other worlds such as: age, differentiation, volcanism, impact cratering, space weathering and more. Specifically, through this course CofC students will derive the potential science to be conducted on possible upcoming missions to the inner and the outer reaches of the solar system. Participating students will be paired with an engineering team at University of Alabama-Huntsville, ESTACA University in France and/or other partnering Universities. Together, each team will design a mission, write a proposal and defend it in front of a review board. Student teams will interactively participate through a combination of presentations, assigned readings, on-line discussions (i.e., WebEx, Skype, Google Groups), classroom exercises and dynamic activities.

READING:
Reading assignments will be assigned according to mission / design schedule and/or your own curiosity in support of your mission. Students are responsible for reading jointly assigned materials as well as those specific to their assigned research team.

ATTENDANCE:
We consider your enrollment in this course evidence of a willingness to learn what we can teach you about exploring the solar system and your specific task, following the guidelines we set forth.
While you and your teammate(s) will be working at your own pace, you are responsible for meeting the reporting deadlines and deliverables.

CLASS PARTICIPATION:
Each student is expected to participate in on-line project discussions with their team (UAH/CofC). As a part of this, you may be asked to lead or co-lead discussions on one or more of the topics. These presentations shall be interactive and dynamic. You will be assigned a project manager (PM) at the University of Alabama- Huntsville as your team-mate and a Principal Investigator (PI) will be assigned for each team here at CofC. Other team members will be assigned task leads as needed/appropriate to your skills. Together, as a TEAM, you will plan, design and present your mission. There will be an external review board evaluating these projects – one of which will be competitively selected as ‘the winner’ at the end of the course.

DELIVERABLES
A report shall be delivered at each major review to accompany the briefing provided by the team to the external review board. The specific requirements for each review are listed below:

Science & System Requirements Review (SR)\(^2\)
The science and System Requirements Review (SR)\(^2\) shall be conducted date/time XXX mission and on date/time for the XXX Mission Design mission. Each project shall be given 45 minutes to present their overview of the science objectives and the mission requirements followed by 30 minutes for questions and answers from the review board. The Concept Description Document (CDD) shall be signed at this review by the project managers, the instructors, and the external review board chairman.

Memorandum of Understanding and Notice of Intent
The Memorandum of Understanding (MOU) and the Notice of Intent (NOI) to propose from each team shall be due on Date/Time via online system (WebCT/OAK). The MOU shall conform to the outline provided by the instructors and shall document the entire team communication network. The NOI shall conform to the requirements outlined in section 6.1.2 of the AO (pg. 46) with additions provided by Amendment 1.

Mission Definition Review
The Mission Definition Review (MDR) shall be conducted on TBD (time). Each team shall be given 24 minutes to present their briefing to the review board and 20 minutes shall be devoted for questions and answers from the review board. The Mission Definition Review Report shall be delivered via the online system (WebCT/OAK) course management system by TBD and copied to both Drs. Hakkila and Runyon. The report and the external review board briefing shall include at a MINIMUM the following information:
- Science Traceability Matrix
- Mission Traceability Matrix
- Mission Concept of Operations
- Baseline / Threshold Science Mission
- Mission Design per requirement b-30, page B-13 of the AO
- Launch Vehicle Compatibility per requirement B-31, page B-13 of the AO
- Mission and Key Subsystems Trade Tree(s)
  - Figures of Merit
  - Decision Analysis
- Trade Study Results
- Path Forward (plan for mission design and proposal)

The report shall be no longer than 30 pages and shall conform to requirements B-2 and B-3 on page B-1 in Appendix B of the Announcement of Opportunity (Discovery 2010) document provided as reference. The page limit does not apply to the cover or the Table of Contents, but
does include any Appendices. The MDR briefing package shall be uploaded into the on-line system (WebCT/OAK) by DATE at 12:00 midnight and copied to both Drs. Hakkila and Runyon.

EVALUATION / GRADING
The lecture component of this course shall be graded on grant proposal contributions and presentations, with fifty percent based on team factors the other fifty percent based on individual factors. The success of your project is based on teamwork and communication!

<table>
<thead>
<tr>
<th>TEAM</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Team Presentations</td>
<td>50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Individual</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Presentations</td>
<td>20</td>
</tr>
<tr>
<td>Reading / Homework</td>
<td>10</td>
</tr>
<tr>
<td>Quizzes</td>
<td>20</td>
</tr>
</tbody>
</table>

Presentations
You will be graded both on your contributions to your science team’s oral presentations and on the overall effectiveness of these team presentations.

Homework
Occasionally, we may assign reading and/or a homework exercise that is relevant to your project/proposal. This is expected to be turned in on time in the proper format.

Quizzes
Q1: You will be quizzed on the AO within the first two weeks of class – make sure read it and become familiar with it! The AO is your textbook for this class.

Q2: Near the end of the semester, we will give you an oral quiz on your proposed project. This is not intended to fluster or scare you, but rather to prepare you for the Final Review Board. Know your project! Why you are doing it. How you are, or may be trying to accomplish the final goals and objectives, and any issues the engineers foresee … and what questions you may have.

Letter grades will be based on a percentage of your total points accumulated:

<table>
<thead>
<tr>
<th>%</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥93%</td>
<td>A</td>
</tr>
<tr>
<td>90-92</td>
<td>A-</td>
</tr>
<tr>
<td>87-89</td>
<td>B+</td>
</tr>
<tr>
<td>83-86</td>
<td>B</td>
</tr>
<tr>
<td>82-80</td>
<td>B-</td>
</tr>
<tr>
<td>77-79</td>
<td>C+</td>
</tr>
<tr>
<td>73-76</td>
<td>C</td>
</tr>
<tr>
<td>72-70</td>
<td>C-</td>
</tr>
<tr>
<td>67-69</td>
<td>D+</td>
</tr>
<tr>
<td>63-66</td>
<td>D</td>
</tr>
<tr>
<td>62-60</td>
<td>D-</td>
</tr>
<tr>
<td>≤59</td>
<td>F</td>
</tr>
</tbody>
</table>

Reference Documents
National Aeronautics and Space Administration, “Announcement of Opportunity, Discovery 2010, NNH10ZDA0070, June7, 2010
Amendment AA0-1, “Discovery Academic AO Requirements”, August 16, 2010
Reading materials related to your target planetary body (Moon, Europa), including previous missions to these sites.
## SAMPLE COURSE OUTLINE

### Course Topics* **

<table>
<thead>
<tr>
<th>WEEK</th>
<th>Topic</th>
<th>Reading / Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Overview of missions *; Intro to AO &amp; Planetary Geology</td>
<td>Powerpoint Activities / AO</td>
</tr>
<tr>
<td>Week 2</td>
<td>Intro to Engineering &amp; Data collection</td>
<td>Papers; Quiz 1</td>
</tr>
<tr>
<td>Week 3</td>
<td>What encompasses a NASA space mission?</td>
<td>Designing a mission</td>
</tr>
<tr>
<td>Week 4</td>
<td>What are science requirements</td>
<td>Science requirements</td>
</tr>
<tr>
<td>Week 5</td>
<td>Geology / Astronomy of the area</td>
<td>Science</td>
</tr>
<tr>
<td>Week 6</td>
<td>Data – what, where, how?</td>
<td>Data collection / interpretation</td>
</tr>
<tr>
<td>Week 7</td>
<td>Draft proposals</td>
<td>NSSDC</td>
</tr>
<tr>
<td>Week 8</td>
<td><strong>Review Board presentation</strong></td>
<td>CDD signed</td>
</tr>
<tr>
<td></td>
<td>Science &amp; System Requirements Review (TBD)</td>
<td></td>
</tr>
<tr>
<td>Week 9</td>
<td>Team – instruments?</td>
<td>Review</td>
</tr>
<tr>
<td>Week 10</td>
<td>Team</td>
<td>Review</td>
</tr>
<tr>
<td>Week 11</td>
<td>Team, Trajectories</td>
<td>Review</td>
</tr>
<tr>
<td>Week 12</td>
<td>Team</td>
<td>Review</td>
</tr>
<tr>
<td>Week 13</td>
<td>Practice Presentations</td>
<td>Quiz 2</td>
</tr>
<tr>
<td>Week 14</td>
<td>Final science presentations to Review Board</td>
<td>Final Draft Due!</td>
</tr>
<tr>
<td>Week 15</td>
<td><strong>Review w/ Board members</strong></td>
<td>Revise &amp; turn in Proposal</td>
</tr>
</tbody>
</table>

*Subject to change based upon NASA Discovery / New Frontiers Office and University partners

**To be augmented and enhanced by personal interaction with your team members at UAH during weekly emails/telecons/ WebEx chats or by whatever means you establish