AUBURN UNIVERSITY

Date: 08/26/2014 *(MM/DD/YYYY)*

Proposal Form For Addition And Revision Of Courses

1. Proposing College / School: Samuel Ginn College of Engineering

Department: Aerospace Engineering

2. Course Prefix and Number: AERO 7410/7416

3. Effective Term: Fall 2015

4. Course Title: Light-Field Imaging

Abbreviated Title (30 characters or less): Light-Field Imaging

5. Requested Action:

- ○ Renumber a Course — Current Course Number:
- ◉ Add a Course — Proposed Course Number:
- ○ Revise a Course — Type of Revision:

6. Course Credit:

Maximum Hours (Repeatability): 3

Contact/Group Hours	Scheduled Type (e.g.: Lab, Lecture, Practicum, Directed Study)	Weekly or Per Term?	Credit Hours	Anticipated Enrollment
3	Lectures	Weekly	3	25

Total Credit Hours: 3

7. Grading Type: ◉ Regular (ABCDF) ○ Satisfactory/Unsatisfactory (S/U) ○ Audit

8. Prerequisites/Corequisites:

Use "P:" to indicate a prerequisite, "C:" to indicate a corequisite, and "P/C:" to indicate a prerequisite with concurrency.

AERO 7160 or departmental approval

9. Restrictions: *List specific restriction in space above.* ☒ College ☐ Major ☐ Standing ☐ Degree

10. Course Description:

(20 Words or Less; exactly as it should appear in the Bulletin)

An introduction to light-field imaging. Topics include light field parameterization, light field cameras, computational photography and Fourier slice photography theorem.

11. May Count Either: AERO 7410 **or** AERO 7416q *(Indicate if this particular course cannot be counted for credit in addition to another)*

12. Affected Program(s):

(Respond "N/A" if not included in any program; attach memorandum if more space is required)

Program Type (e.g.: minor, major, etc.)	Program Title (e.g.: MS in Chemistry, Performance Option, Minor in Art)	Requirement or Elective? (required or optional?)
Graduate	MS in Aerospace Engineering	Elective
Graduate	PhD in Aerospace Engineering	Elective

13. Overlapping or Duplication of Other Units' Offerings:

(If course is included in any other degree program, is used as an elective frequently by other unit(s), or is in an area similar to that covered by another college/school, attach correspondence with relevant unit)

○ Applicable ◉ Not Applicable

14. Justification:

Light field imaging is an emerging field with numerous engineering applications ranging from fluid dynamics measurements to conventional photography. The field has recently experienced growth with the development of imaging hardware capable of measuring the light field directly including the commercial availability of plenoptic cameras and the construction of custom cameras in the Advanced Flow Diagnostics Laboratory in the department of aerospace engineering. The methods used to capture, process and analyze light-field data are unique and not covered in any courses currently available.

(Include a concise, yet adequate rationale for the addition/revision of the course, citing accreditation, assessments (faculty, graduate, and/or external) where applicable)

15. Resources:

No additional resources are required.

(Indicate whether existing resources such as library materials, classroom/laboratory space, and faculty appointments are adequate to support the proposed addition/revision; if additional resources are required, indicate how such needs will be met, referencing the appropriate level of authorization -- i.e.: Dean -- where necessary; if no additional resources or shifting of resources will be necessary, respond "Not Applicable")

16. Student Learning Outcomes:

1. Know the basic definition of a light-field and different methods of parameterizing the light-field
2. Know multiple methods for measuring a light field
3. Be able to apply ray transfer matrices to simulate light fields and light field capture with a plenoptic camera
4. Implement computational algorithms to perform calibration, refocusing and perspective view generation with light field image data captured by a plenoptic camera.
5. Understand the concept of the Fourier slice photography theorem and identify strengths/weaknesses associated with its implementation

(State in measurable terms (reflective of course level) what students should be able to do when they have completed this course)

17. Course Content Outline:

A suitable textbook is not available for the course. As such, course content will mainly be drawn from literature and the instructor's knowledge of the field. The primary references to be covered are:

1. Adelson EH, Wang JYA (1992) Single Lens Stereo with a Plenoptic Camera. Ieee Transactions on Pattern Analysis and Machine Intelligence 14: 99-106.
2. Ng R (2006) Digital light field photography: stanford university.
3. Ng R. Fourier slice photography; 2005. ACM. pp. 735-744.
4. Ng R, Levoy M, Brédif M, Duval G, Horowitz M, et al. (2005) Light Field Photography with a Hand-Held Plenoptic Camera.
5. Georgiev TI, C. (2006) Light Field Camera Design for Integral View Photography.
6. Lumsdaine A, Georgiev T. The focused plenoptic camera; 2009 16-17 April 2009. pp. 1-8.
7. Levoy M (2006) Light fields and computational imaging. Computer 39: 46-+.
8. Levoy M, Ng R, Adams A, Footer M, Horowitz M (2006) Light field microscopy. Acm Transactions on Graphics 25: 924-934.

Course content (Week/Topic):

1. Course overview
2. Conventional imaging optics
3. Ray transfer matrices and affine optics
4. Plenoptic cameras – synthetic image generation
5. Two-plane parameterization
6. Plenoptic camera calibration
7. Multi-dimensional interpolation
8. Computational photography
9. Computational photography
10. Aliasing and supersampling
11. Fourier based methods
12. Fourier based methods

13. Student Oral Presentations
14. Student Oral Presentations
15. Student Oral Presentations
The student presentations are substituted for the Final Exam

(Provide a comprehensive, week-by-week breakdown of course content, including assignment due dates)

18. Assignments / Projects:

In addition to lectures and regular reading assignments, the course will primarily consists of in-depth, hands-on homework assignments that stress practical implementation of concepts discussed in class. In addition, each student will be expected to write a project paper (formated as a peer-reviewed journal article) and give an oral presentation on a select advanced topic related to light field imaging. The purpose of the project is:
1) To provide the student with a deeper understanding of a topic related to light field imaging not covered in the regular course material.
2) To develop students' technical writing and presentation skills.
3) To provide the class with a broader overview of topics related to light field imaging through in-class presentations.
HW Projects 60 %
Research Paper/Presentation 40 %
The course instructor will work with the Engineering Graduate Outreach Program office to conduct lectures in a video studio classroom. Engineering Outreach will deliver video content to distance learning students. The instructor will use Canvas to communicate with students, provide learning materials, and post assignments and grades. Engineering Outreach will arrange exam proctoring services.

(List all quizzes, projects, reports, activities and other components of the course grade -- including a brief description of each assignment that clarifies its contribution to the course's learning objectives)

19. Rubric and Grading Scale:

HW Projects 60 %
Research Paper/Presentation 40 %
90-100% A
80-89% B
70-79% C
60-69% D
<60% F

(List all components of the course grade -- including attendance and/or participation if relevant -- with point totals for each; indicate point totals and ranges or percentages for grading scale; for S/U grading, detail performance expectations for a passing grade)

20. Justification for Graduate Credit:

Light field imaging is a rapidly emerging set of experimental techniques to study very complex fluid flow behavior such as turbulence. Whereas the prerequisite course AERO 7160: Physical Foundations of Turbulence introduces the student to several mathematical models describing turbulent flow behavior, this course examines experimental techniques employed to verify the theoretical models .

(Include a brief statement explaining how the course meets graduate educational standards (i.e.: rigorous standards for evaluation, development of critical thinking and analytical skills, etc.))

(Included below are standard statements regarding course policies. If necessary, a statement may be altered to reflect the academic policies of individual faculty members and/or the academic unit or department, provided that there is no conflict with the Student Policy eHandbook, Faculty Handbook, or any existing university policy.)

POLICY STATEMENTS

Attendance: Although attendance is not required, students are expected to attend all classes, and will be held responsible for any content covered in the event of an absence.

Excused Absences: Students are granted excused absences from class for the following reasons: illness of the student or serious illness of a member of the student's immediate family, the death of a member of the student's immediate family, trips for student organizations sponsored by an academic unit, trips for university classes, trips for participation in intercollegiate athletic events, subpoena for a court appearance, and religious holidays. Students who wish to have an excused absence from class for any other reason must contact the instructor in advance of the absence to request permission. The instructor will weigh the merits of the request, and render a decision. When feasible, the student must notify the instructor prior to the occurrence of any excused absences, but in no case shall such notification occur more than one week after the absence. Appropriate documentation for all excused absences is required. Please consult the **Student Policy eHandbook** for more information on excused absences.

Make-Up Policy: Arrangement to make up a missed major examination (e.g.:hour exams, mid-term exams) due to properly authorized excused absences must be initiated by the student within one week of the end of the period of the excused absence(s). Except in unusual circumstances, such as the continued absence of the student or the advent of university holidays, a make-up exam will take place within two weeks of the date that the student initiates arrangements for it. Except in extraordinary circumstances, no make-up exams will be arranged during the last three days before the final exam period begins.

Academic Honesty Policy: All portions of the Auburn University student academic honesty code (Title XII) found in the **Student Policy eHandbook** will apply to university courses. All academic honesty violations or alleged violations of the SGA Code of Laws will be reported to the Office of the Provost, which will then refer the case to the Academic Honesty Committee.

Disability Accommodations: Students who need accommodations are asked to electronically submit their approved accommodations through AU Access and to arrange a meeting during office hours the first week of classes, or as soon as possible if accommodations are needed immediately. If you have a conflict with my office hours, an alternate time can be arranged. To set up this meeting, please contact me by e-mail. If you have not established accommodations through the Office of Accessibility, but need accommodations, make an appointment with the Office of Accessibility, 1228 Haley Center, 844-2096 (V/TT).

Approvals

Joe Majdalani Department Chair / Head	1/13/15 Date
Steve R. Dr College / School Curriculum Committee	1/22/15 Date
 College / School Dean	1/22/15 Date
 Dean of the Graduate School *(for Graduate Courses)*	 Date
 Assoc. Provost for Undergraduate Studies *(for Undergraduate Courses)*	 Date

Contact Person:	Steve Gross	**Telephone:**	4-6846
E-Mail Address:	grossrs@auburn.edu	**Fax:**	