

1. Catalog Description – (3 credits) Fundamentals of computational photography, sensing, imaging and illumination.
2. Pre-requisites – (EEL 3135 or equivalent) or consent of instructor
3. Course Objectives - The student will be able to demonstrate the basics of computational photography, as it relates to applications in computer vision, graphics and imaging. The student will be able to explain how models of light from radiometry and optics can be used to understand scene information from images, build novel sensors and create new photographs; the intersection between computing and light, a “camera culture” perspective of technology, professionally use sensors and cameras. The student will be able to write code to create new photographs.
4. Contribution of course to meeting the professional component (ABET only – undergraduate courses) – NA
5. Relationship of course to program outcomes (ABET only undergraduate courses) – NA
6. Instructor – Dr. Sanjeev J. Koppal
  - a. Office location: 437 NEB
  - b. Telephone: 352-392-8942
  - c. E-mail address: [sjkoppal@ece.ufl.edu](mailto:sjkoppal@ece.ufl.edu)
  - d. Class Web site: <https://www.ece.ufl.edu/users/koppal-sanjeev-j>
  - e. Office hours: 1:00 p.m. – 2:00 p.m., Fridays
7. Teaching Assistant - None
8. Meeting Times and Location – Monday, Wednesday, Friday, 5<sup>th</sup> period (11:45 a.m. – 12:35 p.m., 330 Larsen
9. Class/laboratory schedule – 3 class periods each week consisting of 50 minutes each
10. Material and Supply Fees - None
11. Textbooks and Software Required - Published research articles provided by instructor
12. Recommended Reading -
  - a. Title: Robot Vision
  - b. Author: B. K. P. Horn
  - c. Publication date and edition: MIT Press 1986
  - d. ISBN number: 0262081598
  
  - a. Title: Multiple View Geometry in Computer Vision
  - b. Author: Richard Hartley and Andrew Zisserman

- c. Publication date, edition, and company: Cambridge
- d. ISBN number: 9780521540513

### 13. Course Outline –

#### Week 1:

- Lec 1: History of cameras, sensors and light
- Lec 2: Camera culture and computational photography
- Lec 3: Pixels, Video and Art

#### Week 2:

- Lec 4: Reflectance: basic principles
- Lec 5: Image processing

#### Week 3:

- Lec 6: Reflectance: algorithms and measurements
- Lec 7: Camera calibration
- Lec 8: Image Warping and morphing

#### Week 4:

- Lec 9: Lighting and shadows
- Lec 10: Programmable imaging
- Lec 11: Human head rendering

#### Week 5:

- Lec 12: Interreflections
- Lec 13: Structured light
- Lec 14: Image pyramids, retargeting and fusing images

#### Week 6:

- Lec 15: Reflection and refraction
- Lec 16: Superresolution
- Lec 17: Mosaicing images

#### Week 7:

- Lec 18: Caustics of cameras and reflections
- Lec 19: Flutter shutter and temporal coding

#### Week 8: (Midterm)

- Lec 20: Light polarization
- Lec 21: Camera arrays - 1
- Lec 22: Optical flow and motion

#### Week 9:

- Lec 23: Basic principles of scattering
- Lec 24: Camera arrays - 2
- Lec 25: Spatial textures

#### Week 10:

- Lec 26: Advanced scattering in vision and graphics
- Lec 27: Catadioptric cameras
- Lec 28: Temporal textures

#### Week 11:

- Lec 29: Modeling fluids
- Lec 30: Stereo with planar mirrors
- Lec 31: Create digital mattes

Week 12:

Lec 32: Optical processing with diffraction

Lec 33: Deblurring

Lec 34: HDR images

Week 13:

Lec 35: Interference and angle sensitive pixels

Lec 36: Polarization imaging

Lec 37: Geometry from a single image

Week 14:

Lec 38: High-speed flash photography

Week 15:

Lec 39: Photo tourism

Lec 40: Image-based rendering

Lec 41: Transient imaging

Week 16:

Lec 42: Presentations (Graduate student's report due)

Lec 43: Presentations (Graduate student's report due)

14. Attendance and Expectations - Cell phones and other electronic devices are to be silenced. No text messaging during class or exams.

This course is co-listed with the undergraduate class. The presentations are group efforts. The groups consist of a mixture of graduate and undergraduate students.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found in the online catalog at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

15. Grading –

15% In class projects

20% Participation

15% Presentation (Graduate student's report is part of presentation)

25% Midterm

25% Final

The homework portion of the graduate section will involve additional work and more advanced concepts with respect to the undergraduate section. The exams will also involve more advanced concepts with respect to the undergraduate section. Graduate students are required to write a report on the presentation while the undergraduate section does not.

16. Grading Scale –

|        |       |       |       |       |       |       |       |       |       |       |      |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| A      | A-    | B+    | B     | B-    | C+    | C     | C-    | D+    | D     | D-    | E    |
| 93-100 | 90-92 | 87-89 | 83-86 | 80-82 | 77-79 | 73-76 | 70-72 | 67-69 | 63-66 | 60-62 | 0-59 |

“Graduate students, in order to graduate, must have an overall GPA of 3.0 or better (B or better).” Note: a B- average is equivalent to a GPA of 2.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

17. Make-Up Exam Policy - If you have a University-approved excuse and arrange for it in advance, or in case of documented emergency, a make-up exam will be allowed and arrangements can be made for making up missed work. University attendance policies can be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Otherwise, make-up exams will be considered only in extraordinary cases, and must be taken before the scheduled exam. The student must submit a written petition to the instructor two weeks prior to the scheduled exam and the instructor must approve the petition.

18. Honesty Policy – UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<http://www.dso.ufl.edu/scrc/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

19. Accommodation for Students with Disabilities – Students requesting classroom accommodation must first register with the Dean of Students Office. That office will provide documentation to the student who must then provide this documentation to the course instructor when requesting accommodation.

20. UF Counseling Services – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
- UF Counseling & Wellness Center, psychological and psychiatric services, 3190 Radio Rd, 392-1575, online: <http://www.counseling.ufl.edu/cwc/Default.aspx>,
  - Career Resource Center, Reitz Union, career and job search services, 392-1601.
  - University Police Department, 392-1111 or 911 for emergencies

21. Software Use – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

22. Course Evaluation – Students are expected to provide feedback on the quality of instruction in this course based on 10 criteria. These evaluations are conducted online at: <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks

of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at: <https://evaluations.ufl.edu/results>.