**FLORIDA ATLANTIC UNIVERSITY**

**Graduate Programs—NEW COURSE PROPOSAL**

**DEPARTMENT:** BIOLOGICAL SCIENCES  
**COLLEGE:** COLLEGE OF SCIENCE

**RECOMMENDED COURSE IDENTIFICATION:**

Prefix **EVS**  
Course Number **5385**  
Lab Code (L or C)

**TO OBTAIN A COURSE NUMBER, CONTACT** MIJINNING@FAU.EDU

**COMPLETE COURSE TITLE:** Image and Video Processing and Vision in Marine Environment

**CREDITS:** 3  

**EFFECTIVE DATE:**  
Spring 2010

**GRADING (SELECT ONLY ONE GRADING OPTION):**  
REGULAR **X**  
SATISFACTORY/UNSATISFACTORY

**COURSE DESCRIPTION, NO MORE THAN THREE LINES:** Course studies the fundamentals of electro-optical image and video processing in the underwater environment. Covers topics such as underwater image and video enhancement techniques, underwater stereo vision, and emerging underwater imaging system concepts.

**PREREQUISITES:** Introduction to Digital Signal Processing (EELA510); or consent of instructor

**COREQUISITES:**

**REGISTRATION CONTROLS (MAJOR, COLLEGE, LEVEL):**

* PREREQUISITES, COREQUISITES AND REGISTRATION CONTROLS WILL BE ENFORCED FOR ALL COURSE SECTIONS.

**MINIMUM QUALIFICATIONS NEEDED TO TEACH THIS COURSE:** Ph.D. IN THE RELEVANT FIELD

**Faculty contact, email and complete phone number:**  
Dr. Bing Ouyang  
bouyang@tau.edu  
(772) 242-2288

**Please consult and list departments that might be affected by the new course and attach comments.**

**Approved by:**

Department Chair:  
College Curriculum Chair:  
College Dean:  
UGPC Chair:  
Graduate College Dean:  
UFS President:  
Provost:

**Date:**  
1/30/14  
2/10/14  
3/10/14

1. Syllabus must be attached; see guidelines for requirements:  

2. Review Provost Memorandum:  
Definition of a Credit Hour  
www.fau.edu/provost/files/Definition_Credit_Hour_Memo_2012.pdf

3. Consent from affected departments (attach if necessary)

Email this form and syllabus to UGPC@fau.edu one week before the University Graduate Programs Committee meeting so that materials may be viewed on the UGPC website prior to the meeting.

FAUnivGrad—Revised September 2013
1. Course title/number, number of credit hours
Image and Video Processing and Vision in Marine Environment – EVS 5385 – 3 credit hours

2. Course prerequisites
   a. Introduction to Digital Signal Processing (EEL4510) or equivalent
   or
   b. Permission of the instructor.

3. Course logistics
   a. Term – Spring 2015
   b. Notation if online course – N/A
   c. Class location and time (if classroom-based course) – To be determined

4. Instructor contact information
   a. Instructor’s name – Bing Ouyang
   b. Office address – HBOI Link Building Rm 130
   c. Office hours – To be determined
   d. Contact telephone number – office (772) 242-2288, fax (772) 242-2257
   e. E-mail address – bouyang@fau.edu

5. TA contact information (if applicable)
   N/A

6. Course description
This course will expose the students to the fundamentals of electro-optical image and video processing in the underwater environment. Potential topics include the basics of image and video processing and computer vision, underwater image and video enhancement techniques, underwater stereo vision, and emerging underwater imaging system concepts.

7. Course objectives/student learning outcomes
This course introduces the fundamentals of image/video processing and computer vision techniques and how to apply these techniques to improve the performance of underwater imaging systems and enhance the subsea visibility.

   • Gain basic understanding of image and video processing and computer vision;
   • Gain basic knowledge of the effective techniques to enhance and restore the underwater electro-optical imagery;
   • Gain basic level understanding of the application of some new signal processing concepts such as the compressive sensing theory in the underwater electro-optical system design.
8. **Course evaluation method**

There will be graded homework assignments accounting for 30% of the student's cumulative performance, a term project that accounts for 30% of the student's cumulative performance, a first exam that accounts for 15% of the student's cumulative performance, and a second exam that accounts for 25% of the cumulative performance. The overall grade in the course is derived from the cumulative performance according to the following table.

9. **Course grading scale (optional)**

<table>
<thead>
<tr>
<th>Cumulative Performance</th>
<th>Grade</th>
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</thead>
<tbody>
<tr>
<td>&gt;94%</td>
<td>A</td>
</tr>
<tr>
<td>&gt;90% - 94%</td>
<td>A-</td>
</tr>
<tr>
<td>&gt;87% - 90%</td>
<td>B+</td>
</tr>
<tr>
<td>&gt;83% - 87%</td>
<td>B</td>
</tr>
<tr>
<td>&gt;80% - 83%</td>
<td>B-</td>
</tr>
<tr>
<td>&gt;75% - 80%</td>
<td>C+</td>
</tr>
<tr>
<td>&gt;65% - 75%</td>
<td>C</td>
</tr>
<tr>
<td>&gt;60% - 65%</td>
<td>C-</td>
</tr>
<tr>
<td>&gt;57% - 60%</td>
<td>D+</td>
</tr>
<tr>
<td>&gt;53% - 57%</td>
<td>D</td>
</tr>
<tr>
<td>&gt;50% - 53%</td>
<td>D-</td>
</tr>
<tr>
<td>&lt;50%</td>
<td>F</td>
</tr>
</tbody>
</table>

10. **Policy on makeup tests, late work, and incompletes**

If a student cannot attend an exam or hand in a homework project on time due to circumstances beyond their control then the instructor may assign appropriate make-up work. Students will not be penalized for absences due to participation in University-approved activities, including athletic or scholastics teams, musical and theatrical performances, and debate activities. These students will be allowed to make up missed work without any reduction in the student's final course grade. Reasonable accommodation will also be made for students participating in a religious observance. Also, note that grades of Incomplete ("I") are reserved for students who are passing a course but have not completed all the required work because of exceptional circumstances. A grade of "I" will only be given under certain conditions and in accordance with the academic policies and regulations put forward in FAU’s University Catalog. The student must show exceptional circumstances why requirements cannot be met. A request for an incomplete grade has to be made in writing with supporting documentation, where appropriate.

11. **Special course requirements (if applicable)**

N/A

12. **Classroom etiquette policy (if applicable)**

University policy on the use of electronic devices states: “In order to enhance and maintain a productive atmosphere for education, personal communication
devices, such as cellular telephones and pagers, are to be disabled in class sessions.”

13. Disability policy statement
In compliance with the Americans with Disabilities Act (ADA), students who require special accommodation due to a disability to properly execute coursework must register with the Office for Students with Disabilities (OSD) -- in Boca Raton, SU 133 (561-297-3880); in Davie, MOD 1 (954-236-1222); in Jupiter, SR 117 (561-799-8585); or at the Treasure Coast, CO 128 (772-873-3305) – and follow all OSD procedures.

14. Honor Code policy statement
Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty, including cheating and plagiarism, is considered a serious breach of these ethical standards, because it interferes with the University mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the University community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001 at http://www.fau.edu/regulations/chapter4/Reg_4.001_5-26-10_FINAL.pdf

15. Required texts/readings

Required readings:


16. Supplementary/recommended readings (optional)


17. Course topical outline

<table>
<thead>
<tr>
<th>Topics</th>
<th>Homework</th>
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</table>


<table>
<thead>
<tr>
<th></th>
<th>Subject</th>
<th>Assignment/Proposal/Review Papers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Image representation (sampling, quantization)</td>
<td>Homework assignment 1: (Programming) Set up programming environment (Matlab/OpenCV); basic image and video import/export</td>
</tr>
<tr>
<td>2</td>
<td>Visual perception and color spaces</td>
<td>Write the term project proposal</td>
</tr>
<tr>
<td>3</td>
<td>Overview of passive and active underwater electro-optical systems</td>
<td>Review papers [1-3]</td>
</tr>
<tr>
<td>4</td>
<td>Image probability density models</td>
<td>Homework assignment 2: (Programming) image noise</td>
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<tr>
<td>5</td>
<td>Spatial domain and transform domain image filtering</td>
<td>Homework assignment 3: textbook problems on image filtering</td>
</tr>
<tr>
<td>6</td>
<td>Advanced underwater image enhancement and restoration 1: passive imaging systems;</td>
<td>Review papers [4-6]</td>
</tr>
<tr>
<td>7</td>
<td>Advanced underwater image enhancement and restoration 2: active imaging systems;</td>
<td>Review papers [7-10]</td>
</tr>
<tr>
<td>8</td>
<td>Image feature extraction and image mosaic</td>
<td>Prepare for the first exam</td>
</tr>
<tr>
<td>9</td>
<td>Image and video compression</td>
<td>Homework assignment 4: (Programming) image compression</td>
</tr>
<tr>
<td>10</td>
<td>Video noise reduction</td>
<td>Homework assignment 5: (Programming) video enhancement</td>
</tr>
<tr>
<td>11</td>
<td>Motion analysis and object recognition</td>
<td>Homework assignment 6: (Programming) object detection from underwater video</td>
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<tr>
<td>12</td>
<td>Passive underwater stereo vision</td>
<td>Homework assignment 7: (Programming) calibration of stereo imaging system</td>
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<tr>
<td>13</td>
<td>Active underwater stereo vision</td>
<td>Homework assignment 8: (Programming) Structured lighting stereo vision in underwater environment</td>
</tr>
<tr>
<td>14</td>
<td>Image based rendering in underwater vision</td>
<td>Review papers [11,12]</td>
</tr>
<tr>
<td>15</td>
<td>Introduction to the compressive sensing theory</td>
<td>Review papers [13-15]</td>
</tr>
<tr>
<td>16</td>
<td>Compressive sensing based underwater imaging system</td>
<td>Preparing for the second exam and complete term project</td>
</tr>
</tbody>
</table>