A. **COURSE INFORMATION**

Course number/section: CMSS 6328.001, ESCI 5490  
Class meeting time: MW 02:00 03:15PM  
Class location: TBA  
Course Website: TBA

B. **INSTRUCTOR INFORMATION**

Instructor: Darek Bogucki  
Office location: HRI 118  
Office hours: MW 03:30 06:00PM  
Telephone: 361-825-2836  
e-mail: darek.bogucki@tamucc.edu  
Appointments: TBA

C. **COURSE DESCRIPTION**

**Catalog Course Description**
The class focus is on coastal physical processes, upper ocean dynamics with elements of the optical remote sensing.

**Extended Course Description**
The coastal ocean is a complex, dynamic and highly variable system, with processes operating over a large range of scales: from kilometers to millimeters. To characterize coastal ocean’s variability and predict its responses to climatic or man made changes requires understanding of underlying physical processes and continuous in situ sampling augmented by high resolution remote sensing data.

Interest in the nearsurface layer of the ocean rapidly increased along with the development of remote sensing techniques. The interpretation of ocean surface signals sensed from satellites demands thorough knowledge of upper ocean processes and their connection to the ocean interior.

Aquatic surface microlayers are just a few tens of micrometers deep at the air–water interface and are chemically and physically distinct from the subsurface water below. Occurring on all bodies of water, surface microlayers are unique, yet widely distributed microbial ecosystems. In addition the surface layer in its chemical composition as it is enriched in organic compounds.

The course will provide a comprehensive account of the physics as well as some chemistry and biology of the near-surface layer of the ocean under different environmental conditions.
The course is roughly divided into four distinct parts:

1. In part (1) we introduce the essentials of the coastal ocean dynamics.
2. That part will cover physics of oceanic near-surface processes including dispersion. Following that we overview of the near-surface biology (neuston) and the near-surface chemistry.
3. The third part will cover introduction to ocean optics with inclusion of infrared and remote passive/active sensing and connect the remote observations to near-surface dynamics.
4. The last part of the course will consist of reading assignments and projects to address cutting edge topics from (1) (2) and (3).

**Work load**

Mastering the material covered in this course requires a significant amount of work outside of class. Students should expect to spend more time outside of class than in class – typically at least twice as much time. The course will be based on textbooks (1) (2) (3), assigned readings (4), case analyses (4), and student projects (4).

The students’ progress will be monitored via assignments.

**Course Audience**

Ph.D. and MS students in the Coastal and Marine Science System Science, Marine Biology, Environmental Science Program are the primary audience for this course. Secondary audience includes: Masters graduate students in Mathematics, Computer Science and students in Mechanical Engineering.

**Tentative topics:**

- Introduction to fluid dynamics: equation of motions, streamlines, no-slip boundary condition at solid fluid-interface, boundary layers, instabilities and turbulence. [1]
- Coastal oceanography: Ekman dynamics, tides, wind forcing, waves, buoyancy/estuary physics, particle dynamics, dispersion, re-suspension. [2]
- Introduction to upper ocean dynamics: molecular sublayers, turbulence and waves, buoyancy effects, fine thermohaline structure of the near-surface layer of the ocean, spatially coherent organized motions having surface manifestations, and the high wind-speed regime. [3]

Assignments related to students thesis and coastal physics.

**D. PREREQUISITES AND COREQUISITES**

None

**E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES**
Selected textbooks chapters from:


Additional reading:
- Journal papers related to addressed topics during class.

F. STUDENT LEARNING OUTCOMES AND ASSESSMENT

Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to both students and instructors. A critical step in this process is making clear the course’s student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes for this course are listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning.

By the end of this course, students should be able to:

1. Acquire understanding of the basic physical processes taking place in the coastal ocean.
2. Construct a model needed to predict and monitor the trajectory and of oil spills and contaminants.
3. Understand the physical response of the coast seas to the climatic changes and human impact.
4. Understanding of air-sea fluxes and upper ocean dynamics.
5. Find limitations and advantages of various remote sensing instruments and platforms.
6. Choose appropriate sensing method in coastal research, monitoring or Homeland Security applications.

G. INSTRUCTIONAL METHODS AND ACTIVITIES

The course will be taught in a lecture, discussion, and case-study format. Weekly reading will be assigned. The assigned readings will correspond to student level and their interests. There will be a number of assignments requiring a short presentation and in class discussion. There will be written assignment following the completion of each of the topic. There will be oral presentation at the end of the term. A midterm and final exam will be given.
H. MAJOR COURSE REQUIREMENTS AND GRADING

Grading Criteria:
- Assignments combined (combined from oral presentation and written assignments) = 50%
- Midterm exam = 25%
- Final project presentation = 25%

The final grade:
Below X denotes your point average, and then your grade will be found as:

<table>
<thead>
<tr>
<th>Class Average (X)</th>
<th>Grade</th>
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<tbody>
<tr>
<td>X &gt; 90.0%</td>
<td>A - Excellent</td>
</tr>
<tr>
<td>80% ≤ X ≤ 90.0%</td>
<td>B – Good</td>
</tr>
<tr>
<td>70% ≤ X &lt; 80.0%</td>
<td>C - Satisfactory</td>
</tr>
<tr>
<td>60% ≤ X &lt; 70.0%</td>
<td>D - Passing</td>
</tr>
<tr>
<td>X &lt;60.0%</td>
<td>F - Failing</td>
</tr>
</tbody>
</table>

I. COURSE CONTENT/SCHEDULE

<table>
<thead>
<tr>
<th>DATE (BY DAY OR WEEK)</th>
<th>TOPIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wk. 1 Jan 17</td>
<td>What is fluid? Dimensional analysis, non-dimensional numbers: Reynolds#, stress in fluids, viscosity</td>
</tr>
<tr>
<td>Wk. 2 Jan 22</td>
<td>Bernoulli theorem, streamlines, no-slip boundary, boundary layer concept</td>
</tr>
<tr>
<td>Wk. 3 Jan 29</td>
<td>Instability, transition to turbulence. Continuity equation, D/Dt operator, hydrostatic effects, Navier Stokes equation.</td>
</tr>
<tr>
<td>Wk. 4 Feb 5</td>
<td>Physical Oceanography: Seawater Properties, Rotation and Geostrophy; surface waves.</td>
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<tr>
<td>Wk. 5 Feb 12</td>
<td>Ocean Dynamics and Circulation, Wind-driven Circulation Stirring/Mixing</td>
</tr>
<tr>
<td>Wk. 6 Feb 19</td>
<td>Turbulence: fine structure and microstructure,</td>
</tr>
<tr>
<td>Wk. 7 Feb 26</td>
<td>Oceanic dispersion and diffusion; particle dynamics, resuspension</td>
</tr>
<tr>
<td>Wk. 8 March 5</td>
<td>Introduction to ocean optics: inherent/apparent water properties, solar radiation, radiative transport equation, long wave radiation</td>
</tr>
<tr>
<td>Wk. 9 March 12</td>
<td>Albedo of the sea surface, light attenuation, solar light IR oceanic measurements, effect of penetrating solar radiation</td>
</tr>
<tr>
<td>Wk. 10 March 19</td>
<td>Sea Surface microlayer: viscous sublayer, thermal sublayer (cool skin), diffusion sublayer, convective or shear layer</td>
</tr>
<tr>
<td>Wk. 11 March 26</td>
<td>Sea surface microlayer ecosystem, Surfactants and surface films, surface chemistry, chemical and photochemical reactions in the sea surface microlayer</td>
</tr>
<tr>
<td>Wk. 12 Apr 2</td>
<td>Near surface turbulence, coherent structures, low/ high wind conditions</td>
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<tr>
<td>Wk. 13 Apr 9</td>
<td>Electromagnetic radiation, remote optical sensing passive/active. Oceanic Lidar-applications. Future of active remote sensing: electromagnetic beams with</td>
</tr>
</tbody>
</table>
orbital angular momentum. Remote sensing platforms: space and drones- which one is good for your research?

<table>
<thead>
<tr>
<th>Wk. 14 Apr 16</th>
<th>Final Presentations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wk. 15 Apr 23</td>
<td>Final Presentations</td>
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</tbody>
</table>

Note: Changes in this course schedule may be necessary and will be announced to the class by the Instructor. The assignments and exams shown are directly related to the Student Learning Outcomes described in Section F.

J. COURSE POLICIES

Attendance/Tardiness
Students should attend all class meetings. Participation is essential to do well in the class. Discussions and student input are considered an important part of the class. Class exams cannot be retaken other than for an excused absence. Excused absences are limited to medical emergencies that can be certified in writing by a physician, participation in a TAMUCC sanctioned event or other similar circumstances justified in writing and specified in the TAMUCC graduate catalog for the ongoing academic year.

Late Work and Make-up Exams
Assignments are expected on time unless prior arrangements are made. Such prior arrangements will be granted only in exceptional circumstances as well. Submitting an assignment late without prior arrangement may lead to a grade of 0 and at least to a substantial penalty.

Cell Phone Use
Not permitted

Food in Class
Not permitted

K. COLLEGE AND UNIVERSITY POLICIES

- Academic Integrity (University)
  University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in a failing grade.

- Classroom/Professional Behavior
Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

- **Statement of Civility**
  Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of sex, ethnic/racial origin, religious background, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.

- **Deadline for Dropping a Course with a Grade of W (University)**
  The grade of W will be assigned to any student officially dropping a course. Please consult with the instructor before you decide to drop to be sure it is the best thing to do. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Should dropping the course be the best course of action, visit the Office of the University Registrar for the Course Drop Form that must submitted. No student is eligible to receive a W without completing the official drop process by this deadline. Please consult the Academic Calendar ([http://www.tamucc.edu/academics/calendar/](http://www.tamucc.edu/academics/calendar/)) for the last day to drop a course.

- **Grade Appeals (College of Science and Engineering)**
  As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at [http://www.tamucc.edu/provost/university_rules/index.html](http://www.tamucc.edu/provost/university_rules/index.html), and the College of Science and Engineering Grade Appeals webpage at [http://sci.tamucc.edu/students/GradeAppeal.html](http://sci.tamucc.edu/students/GradeAppeal.html). For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the
Office of the Provost.

- **Disability Services**
  The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116.

  If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

  [http://disabilityservices.tamucc.edu/](http://disabilityservices.tamucc.edu/)

- **Statement of Academic Continuity**
  In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University–Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.

L. **OTHER INFORMATION**

- **Academic Advising**
  The College of Science & Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an appointment. The College’s Academic Advising Center is located in Center for Instruction 350 or can be reached at (361) 825-3928.

**GENERAL DISCLAIMER**

I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.