

**Course Name:** River-sea interactions

**Number of credits:** 4,5 ECTS

**Period:** Fall/spring semester

Coordinator	Institute of Oceanography
Credits	4,5 ECTS
Lecturers	<b>Bui Hong Long, Phan Minh Thu</b>
Level	BSc.
Host institution	Ho Chi Minh City University of Natural Resources and Environment
Course duration	1 semester (the classes will be scheduled in accordance with the university timetable)
New/revised	New course

### Summary

- Provide the knowledge of the influence of the river into the sea; identify scientific issue of upper boundary of sea impacts into the river, supporting to determinate the scope of coastal management.
- Provide the approaches to identify marine fronts (hydrology, tide...) that help to detect potential areas for high primary productivity and fishing grounds;
- Understand the approaches to determinate the Regions Of Fresh water Influence (ROFI) in the coastal areas as well as the areas affected by physical processes (such as stratification, disturbance caused by wind, waves, tides and currents).
- Provide the knowledge of river - sea interaction processes and theirs influence by the of socio-economic development and climate change.

### Target student audiences

BSc. students majoring in Marine Resources Management

### Prerequisites

Required courses (or equivalents): Oceanology, hydrology, hydrodynamics, hydrodynamic processes in estuaries

### Aims and objectives

The main course objective is to equip students with knowledge of:

- In terms of knowledge:
  - Understand features of morphology and type of estuarine, as well as the hydrological, dynamic, environmental, ecological and resource characteristics of estuaries.

- Understand processes of river-sea interaction, estuarine changes under the nature impacts, socio-economic activities and climate change.
- determinate scientific problems on estuaries, river-sea interaction.
- In practical terms:
  - The role of estuaries in local and regional socio-economic development.
  - Provide the methods that how to organize surveys/field trips, to collect scientific data and documents for researches.
  - Provide professional skills to lead any scientific topics.

**The Authentic Tasks:**

The course provides basic knowledge of types of estuaries, river-sea interaction.

**General learning outcomes:**

By the end of the course, successful students will:

Knowledge	<ul style="list-style-type: none"> <li>• Understand estuaries are semi-enclosed waters, the transition areas between the continent and the sea, including water specific features of physical, aquatic chemical and biological environment. These areas are transitional ecosystems between of fresh and seawater with the complexity changes of natural processes and human impacts.</li> <li>• In terms of science, the study of estuaries is very complicated due to the natural processes and anthropological impacts</li> <li>• In practical terms, the estuaries and adjacent areas provide very high socio-economic value. Thus, to understand the river -sea interaction processes, the approaches and methods have to be modern and suitable for the specific conditions of the actual estuaries</li> </ul>
Comprehensive	<ul style="list-style-type: none"> <li>• Presenting the basic knowledge of features of estuaries as well as river-sea interaction processes.</li> </ul>
Application	<ul style="list-style-type: none"> <li>• Organize the survey/field trips in the estuaries.</li> <li>• Collect data, information of the basic parameters of hydrodynamics, water exchange, materials... that provide the inputs for simulation models.</li> <li>• Determine the spatial distribution and time fluctuations of the river-sea interaction.</li> </ul>
Analysis	<ul style="list-style-type: none"> <li>• Apply to analysis the data that collected from several database and field trips</li> </ul>
Synthesis	<ul style="list-style-type: none"> <li>• Review, evaluate and systematize ideas and select suitable methods to scientific subjects.</li> </ul>

**Overview of sessions and teaching methods**

The course will make most of interactive and self-reflective methods of teaching and learning and, where possible, avoid standing lectures and presentations

- Learning methods**
- Video presentations
  - Lecture notes and Literature review
  - Interview, survey, fieldwork, group work, essay writing

### Course outline

Week	Topics
Week 1 & 2	Introduction, Chapter 1
Week 3 & 4	Chapter 2 and assignment
Week 5 & 6	Chapter 3 and assignment
Week 7 & 8	Chapter 4 and assignment
Week 9	Group presentation

### Course Schedule

<b>Topic 1 - Introduction, Chapter 1: Estuaries</b>	
Learning objectives	<ul style="list-style-type: none"> <li>• Help students to know the role of estuaries; to understand the definitions estuaries and how-to class estuaries; to have the knowledge of their dynamics and hydrological features</li> </ul>
Learning outcomes	<ul style="list-style-type: none"> <li>• Use definitions and criteria to class specific estuaries</li> </ul>
Student deliverables	<ul style="list-style-type: none"> <li>• Discussion: Classification of estuaries:               <ul style="list-style-type: none"> <li>○ morphological method</li> <li>○ hydrodynamic method.</li> </ul> </li> <li>• Semi – Final examination</li> <li>• Final examination</li> </ul>
Topic materials	Lecture: <ul style="list-style-type: none"> <li>• Lecture and Literature materials</li> </ul>
<b>Outline</b>	1.1 Why is it necessary to study the estuary. 1.2 The concepts and definitions of estuaries 1.3 Water circulation in estuarine regions 1.4 Effects of coastal currents, ocean waves on river outflow 1.5 Effects of storm with river mouth flow 1.6 Circulation in semi-enclosed estuaries (lagoon,...).
<b>Topic 2- Dynamics of sediment in estuaries</b>	
Learning objectives	<ul style="list-style-type: none"> <li>• Understand the estuarine sediment processes (transport, sedimentation ...); Material balance in estuarine areas; Impacts of sediments on ecology and environment in ecosystems estuaries.</li> </ul>
Learning outcomes	<ul style="list-style-type: none"> <li>• Calculate material balance in estuarine areas,</li> </ul>

	<ul style="list-style-type: none"> <li>• Determine sediment effects on the environment.</li> </ul>
Student deliverables	<ul style="list-style-type: none"> <li>• Exercise: Calculate the mass of sediment transport in the longshore and long-river.</li> <li>• Semi – Final examination</li> <li>• Final examination</li> </ul>
Topic materials	<p>Lecture:</p> <ul style="list-style-type: none"> <li>• Lecture and Literature materials</li> </ul>
Outline	<p>2.1. The role of sediments in the estuarine ecosystem 2.2. Sand waves in estuaries. 2.3. Sediment dynamics of estuaries. 2.3. Issues of estuarine constructions. 2.4. Organisms on soft bottom of estuaries 2.5. Sediment material balance in estuarine areas.</p>
<b>Topic 3 – Types of Estuaries, exampling in Vietnam</b>	
Learning objectives	<ul style="list-style-type: none"> <li>• Understand the features and river-sea interactions in estuaries</li> <li>• Example in the two cases of large river systems in Vietnam</li> </ul>
Learning outcomes	<ul style="list-style-type: none"> <li>• Determinate study problems in priority order in typical rivers,</li> <li>• Example in the two largest river systems in Vietnam.</li> </ul>
Student deliverables	<ul style="list-style-type: none"> <li>• Exercise</li> <li>• Semi – Final examination</li> <li>• Final examination</li> </ul>
Topic materials	<p>Lecture:</p> <ul style="list-style-type: none"> <li>• Lecture and Literature materials</li> </ul>
Outline	<p>3.1 Red River Estuary 3.2 Mekong estuary 3.3 Central estuaries. 3.4 River-Sea interaction processes 3.5 Interaction of water masses of the Mekong River and strong upwelling in the coastal area of Vietnam 3.6 Problems and challenges for the management, research and development of Vietnamese estuaries.</p>
<b>Topic 4: Natural hazard in estuaries</b>	
Learning objectives	<ul style="list-style-type: none"> <li>• Understand the situation, changes and general trends of Natural hazard in the Vietnam East Sea and estuaries</li> </ul>
Learning outcomes	<ul style="list-style-type: none"> <li>• Presenting the solutions, response approaches to mitigate impacts of natural disasters</li> </ul>
Student deliverables	<ul style="list-style-type: none"> <li>• Exercise</li> <li>• Semi – Final examination</li> <li>• Final examination</li> </ul>

Topic materials	Lecture: <ul style="list-style-type: none"> <li>Lecture and Literature materials</li> </ul>
Outline	<p>4.1. Flooding, drought and salinity instruction in the world, the East Sea, and Vietnam</p> <p>4.2 Storm surge in coastal areas of Vietnam</p> <p>4.3 Damage caused by flooding, drought and salinity instruction.</p> <p>4.4 Offshore and coastal wave processes.</p> <p>4. 5 Waves, water rise during the storm</p> <p>4.6 Methods and approaches to response and to mitigate impacts of natural hazards.</p>

## Literature

[1] Lecture note

[2] Dyer K. R. (1973). Estuaries: A physical introduction. John Willey & Sons.

[3] Job Dronkers, Wim van Leussen (1988). Physical Processes in Estuaries. Springer-Verlag, Berlin Heidelberg New York London Paris Tokyo.

[4] Eric Wolanski, Michael Elliott (2015). Estuarine Ecohydrology: An Introduction (2<sup>nd</sup> editor). Elsevier Science.

## Recommended:

[1] Phan Đình Lợi, Nguyễn Năng Minh, Đo đạc chính lý số liệu thủy văn, NXBXD, 2002.

## Course workload

The table below summarizes course workload distribution:

Activities	Learning outcomes	Assessment	Estimated workload (hours)
<b>In-class activities (45 hours)</b>			
Lectures	Understanding theories, concepts, methodologies and tools for river – sea interaction	Class participation	25
In-class assignments, homework assignment	Application of theoretical knowledge and appropriate methods and tools for doing exercises and practical applications	Class participation and preparedness for assignments	20
<b>Independent work (95 hours)</b>			
Group working	Understand how to apply knowledge, concepts, instrumental methods in river-sea interaction for determinate the research problems, and select appropriate applications to build research proposal for the group.	Quality of group assignments and personal presentation	35

	- Contribute to group projects - Contribute to the preparation and presentations		
Home work and Exercise	Maximize the role of the individuals in the team		30
Group presentation	Discussing and detailing the content presented.	Quality of group assignments and personal presentation	30
<b>Total</b>	<b>140 hours</b>		<b>140</b>

### Course Assignments

Course assignments will constitute a multi-part project:

- Assignment #1 - (home work)
- Assignment #2 - (home work)
- Assignment #3 - (home work)

Assignment #1: will help students understand the role of estuaries; to understand the definitions estuaries and class estuaries; to know their dynamics and hydrological features

Assignment #2: will help students understand Dynamics of sediment in estuaries as well as how to calculate the sediment balance in estuary systems. Students will learn the approaches of estuary dynamics.

Assignment #3, the students are provided the knowledge of estuarine classification. Student will discuss the impacts of natural hazard on situation of estuaries.

### Grading

The students' performance will be based on the following:

- Assessment**
- Progress assessment (30%):
    - Exercise (15%):
    - Homework (15%):
  - Final assessment (60%):
    - Final examination (45%)
    - Semi- Final examination (15%)

- Evaluation**
- A (8,5 – 10)
  - B (7,0 – 8,4)
  - C (5,5 - 6,9)
  - D (4,0 – 5,4)