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Course Name: MODELLING THE MARINE ENVIRONMENT
Number of credits: 4,5 ECTs

Period: Fall/spring semester

Cooordinator	Faculty of Marine Resources and Management
Credits	4,5 ECTs
Lecturers	Nguyen Ky Phung, Tran Thi Kim, Dang Thi Thanh Le
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	revised course (30%)

Summary

The course provides basic knowledge of modeling contaminants transmission processes in marine environments. In addition, the course introduces basic applications of modeling pollution processes in solving practical problems of marine pollution.

Aims and objectives

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

- The processes of the transmission of substances to the marine and ocean environment.
- Determine the marine environment problem and propose suitable solution.
- Basic skills to use model in simulating contaminants transmission processes in marine environment.
- Demonstrate active learning capacity

The Authentic Tasks:

The course provides basic knowledge of modeling pollutant transmission processes in marine environments.

General learning outcomes:

By the end of the course, successful students will:

Knowledge	• Understanding the role of marine environment modeling • Presenting the basic knowledge of flow dynamics and hydrography, the basic knowledge of modeling of substance transmission in marine environment. • Simulating the processes of substance transmission in marine environment. • Analysis of natural systems and design of numerical models

	• Using basic models in simulating contaminants transmission processes in marine environment.
Comprehensive	• Presenting the basic knowledge of flow dynamics and hydrography, the basic knowledge of modeling of substance transmission in marine environment.
Application	• Simulating the processes of substance transmission in water
Analysis	• Analysis of natural systems and design of numerical models
Synthesis	• Using basic models in simulating contaminants transmission processes in marine environment.

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
- Project Based Learning
- Literature review
- Brainstorming
- Puzzles
- Query
- Mind map
- Problem-based learning
  Team work

Course outline

Week	**Topics**
Week 1	Introduction to the Modeling and application
Week 2; 3&4	Dynamics currents and tides
Week 5,6,7, 8, 9 &10	Process of substance transmission
Week 11, 12 &13	Modelling the marine environment and ocean
Week 14 &15	An introduction to model used in simulation marine and ocean environment process

Course Schedule

The course provides basic knowledge of modeling pollutant transmission processes in marine environments and divides into 5 topics as follows:

Topic 1: Introduction to the Modelling and application. This section will introduce the Modelling and application; Numerical model and applications of the numerical model in the environment.

Topic 2: Dynamics currents and tides. This section will focus on Hydrodynamic Equation; Some approximations in marine and ocean studies; Theory of flow, and Ocean tides

Topic 3: Process of substance transmission. This topic will demonstrate the equation of substance transmission; Analytical solutions for some cases; Advection and Diffusion, and the process of substance transmission for non-conservative substance.

Topic 4: Modelling the marine environment and ocean. The content of this topic will concentrate on Computation method and Application of the Finite Difference Method in some specific cases.

Topic 5: An introduction to model used in simulation marine and ocean process. This section will demonstrate the fundamental equations describing currents and boundary conditions, and several modeling applications in the simulation of substance transmission in marine and ocean environments.

Literature

Compulsory

[1]. Lecture of Modeling of the marine environment.

Recommended:

[2] John G. Lyon, Lynn Lyon, Geospatial Information Handbook for Water Resources and Watershed Management, Volume 2: Methods and Modelling, CRC Press, 2022.

[3] Amarendra Sahoo, Assessment of Impact of Mining on Water Quality and It's Modelling [1, 1st ed.], NIT Rourkela, 2017.

[4] Luiz Bruner de Miranda, Fernando Pinheiro Andutta, Björn Kjerfve, Belmiro Mendes de Castro Filho (auth.), Fundamentals of Estuarine Physical Oceanography [1 ed.], Springer Singapore, 2017.

[5] Stanisław Ryszard Massel, Ocean Surface Waves: Their Physics and Prediction [3rd ed.], World Scientific, 2017.

[6] S.E. Jørgensen and M.J. Gromiec (Eds.), Mathematical Submodels in Water Quality Systems, Elsevier Science, 2013.

[7] Marcello Benedini, George Tsakiris, Water Quality Modelling for Rivers and Streams, Springer, 2013.

Course workload

The table below summarizes course workload distribution:

Activities	Learning outcomes	Assessment	Estimated workload (hours)

In-class activities (45 hours)			
Lectures	Understanding theories, concepts, methodology and tools	Class participation	12
Moderated in-class discussions	Understanding the basic knowledge of flow dynamics and hydrography, the basic knowledge of modelling of substance transmission in marine environment.	Class participation and preparedness for discussions	12
In-class assignments, homework assignment	Understanding the basic knowledge of flow dynamics and hydrography, the basic knowledge of modelling of substance transmission in marine environment.	Class participation and preparedness for assignments	12
Reading and discussion of assigned papers for preparation for lectures	Familiarity with and ability to critically and creatively discuss key concepts, tools and methods as presented in the literature	Class participation, creative and active contribution to discussion	9
Independent work (90 hours)			
Home work and Exercise	Ability to interpret data, analyze objects and use concepts, tools, and methods, and equations to solve problems.	Quality of individual assignments	80
Total			***125***

Course Assignments

Course assignments will constitute a multi-part project:

- Assignment #1 -(in-class) : will help students understand the basic knowledge of dynamics currents and tides.
- Assignment #2,3,4 - (home work): will help students understand the basic knowledge of flow dynamics and hydrography, the transmission of substances to the marine and ocean environment.

The students' performance will be based on the following:

Assessment

- Progress assessment (30%):
  - Exercise (15%):
  - Homework (15%):

- Final assessment (60%):
  - Semi- Final examination (10%)
  - Final examination (50%)

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