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Course Name: Marine Ecology
Number of credits: 4,5 ECTs

Period: Fall/spring semester

Cooordinator	Institute of Oceanography
Credits	4,5 ECTs
Lecturers	Phan Minh Thu, Huynh Minh Sang, Hoang Xuan Ben
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

Summary

- Provide an understanding of the patterns of abundance and diversity of marine organisms and the processes in marine ecosystems.
- Understand the complexity of marine systems and how to quantifying them.
- Understand how to design the experiments/ collect data for the development of theory and solutions to environmental and conservation problems in coastal/marine habitats.
- The field work.

Target student audiences
BSc. students majoring in Marine Resources Management

Prerequisites
Required courses (or equivalents): NO

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

- Understanding abundance of marine organisms.
- Understanding ecological processes in marine ecosystems.
- Understanding the effect of humans on marine ecosystem changes and its biogeographic contingencies.
- Improving scientific communication skills and teamwork

The Authentic Tasks:
The course provides basic knowledge of marine ecology.

General learning outcomes:

By the end of the course, successful students will:

Knowledge	• Have a knowledge of ecological characteristics and processes of marine habitats • Understanding the effect of humans on marine ecosystem changes and its biogeographic contingencies. • Develop ability to collect, analyse and interpret marine ecological information
Comprehensive	• Presenting the basic knowledge of ecological characteristics and processes in marine ecosystems.
Application	• Using the knowledge of ecological principles to describe relationships between habitats and organisms in marine environments; applying for coastal and marine management, environmental modelling, biogeochemical cycles.
Analysis	• Analysis of ecosystems and their processes in marine/aquatic ecosystems
Synthesis	• Using the knowledge of marine ecology and biology to understand the dynamic processes in these ecosystems. Therefore, the students can apply the gaps for designing the ecological experiment and building the environmental modelling.

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
- Brainstorming and discussion
- Team work
- Field trip

Course outline

Week	Topics
Week 1, 2 &3	Introduction: Basic ecological terms and concepts Marine ecosystems: abiotic overview Marine biodiversity and Positive and negative biological interactions
Week 4	Primary production
Week 5	Consumers: herbivores and detritivores
Week 6	Biological energy and Food web
Week 7&8	The exploitation and maintenance of marine/ Threats to marine ecosystems
Week 9	Marine conservation

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Course Schedule

Topic 1 - Introduction: Basic ecological terms and concepts	
Learning objectives	• Introduction the Marine ecology • Link between Marine ecology to others
Learning outcomes	• Understanding general overview of marine ecology • Mind map of marine ecology course
Student deliverables	• Small discussion
Topic materials	Lecture: • Lecture of Marine Ecology
Outline	**1.1. Introduction to course of marine ecology** **1.2. Link between Marine ecology to others**
Topic 2- Marine ecosystems: abiotic overview	
Learning objectives	• Aquatic Compartment. • Benthic Compartment.
Learning outcomes	• Presenting the basic knowledge of abiotic compartment in waters and sediment of marine ecosystems. • Effect of abiotic on marine organisms.
Student deliverables	• Group discussion: eg. Physical forcing in marine environments • Presentation • Semi – Final examination • Final examination
Topic materials	Lecture: • Lecture of Marine Ecology
Outline	2.1. Aquatic Compartment • Marine regions (topography) • Chemical Components (Salinity and mineral content, Oxygen, Suspended sediments) • Physical components (Depth, pressure, Light and irradiance, Temperature) • Hydrodynamic (Tides, Waves, Ocean currents, Vertical currents and the global conveyer belt, Local currents) 2.2. Benthic Compartment • Transportation of Marine Sediments
Topic 3 - Marine biodiversity and Positive and negative biological interactions	
Learning	• Understanding the Marine biodiversity

objectives	• Identify positive and negative biological interactions
Learning outcomes	• Presenting the basic knowledge of Marine biodiversity. • Gaps of knowledge of positive and negative biological interactions
Student deliverables	• Exercise: Group discussion: eg. Positive and negative biological interactions • Semi – Final examination • Final examination
Topic materials	Lecture: • Lecture of Marine Ecology
Outline	3.1. Introduction of Marine biodiversity 3.2. Differences in the distribution of biomass and species number 3.3. Factors determining biodiversity and species richness 3.4. Introduction of marine ecosystems: Habitats – mangroves, saltmarsh and estuaries; seagrass and nursery habitats; coral reefs; Fisheries diversity.
Topic 4: Primary production (50% Update)	
Learning objectives	• Deterring the process of photosynthesis of micro- and macro-algae, vegetable • Understanding the limitation factors of photosynthesis processes
Learning outcomes	• Presenting the basic knowledge of the autotrophic level, photosynthesis process. • Gaps of changes in productions in marine ecosystems • Method to determinate of primary production
Student deliverables	• Exercise: group discussion on Environmental forcing on marine production • Semi – Final examination • Final examination
Topic materials	Lecture: • Lecture of Marine Ecology
Outline	4.1. Principal of primary production (PP) • Photosynthesis • Chemosynthesis 4.2. Limitation factors of PP • Biomass • Light intensive • Nutrients • Physical control 4.3. Seasonal and spatial variation of PP
Topic 5- Consumers: herbivores and detritivores	
Learning	• Understanding the herbivores and detritivores groups in marine

objectives	ecosystems. • Determinate how to know the relationship between these groups and within the photosynthesis groups
Learning outcomes	• Presenting the basic knowledge of herbivores and detritivores groups in marine ecosystems. • Presenting the values of these groups in the marine ecosystems
Student deliverables	• Exercise: Group discussion on the role of algal grazers in shaping communities – phase shifts • Semi – Final examination • Final examination
Topic materials	Lecture: • Lecture of Marine Ecology
Outline	5.1. Trophic guilds 5.2. Zoo Community (Phytoplankton grazers) 5.3. Molluscs (Sediment, deposit, filter and suspension feeders) 5.4. Vertebrate Community (Predators) 5.5. Marine Organisms as Habitats of Microorganisms
Topic 6- Biological energy and Food web (Update 50%)	
Learning objectives	• Understanding the basic information of Biological energy and Food web. • The pathway to transfer bioenergy within/without the marine ecosystems
Learning outcomes	• Presenting the basic knowledge of Biological energy and Food web. • Presenting the way to transfer bioenergy in the marine ecosystems
Student deliverables	• Semi – Final examination • Final examination
Topic materials	Lecture: • Lecture of Marine Ecology
Outline	6.1. Food chains and energy transfer 6.2. Food Web 6.3. Mineral cycles
Topic 7- The exploitation and maintenance of marine/Threats to marine ecosystems	
Learning objectives	• Understanding the exploitation and maintenance of marine. • Understanding Threats to marine ecosystems
Learning outcomes	• Presenting the basic knowledge of marine exploitation. • Why we should to protect the marine ecosystems
Student deliverables	• Exercise: Group discussion on Ecosystem stability and thresholds of instability; Local stressors in the ocean – nutrient pollution and

	sedimentation; Global stressors in the ocean – climate change, temperature and acidification • Semi – Final examination • Final examination
Topic materials	Lecture: • Lecture of Marine Ecology
Outline	7.1. The exploitation and maintenance of marine • The over-exploitation of commercial fisheries • The loss of top predators • Habitat damage and loss • Are marine fish populations ever stable? 7.2. Threats to marine ecosystems • Natural threats (Short-term impacts, Long-term and continuous impacts) • Anthropogenic threats (Short-term impacts)
Topic 8- Marine conservation (Update 30%)	
Learning objectives	• Understanding status of Marine conservation. • The ways to improve the marine production for our life.
Learning outcomes	• Presenting the basic knowledge of important issues of Marine conservation. • Method to manage the marine ecosystems
Student deliverables	• Exercise: Group discussion on Marine Protected Areas for Fisheries and biodiversity management • Semi – Final examination • Final examination
Topic materials	Lecture: • Lecture of Marine Ecology
Outline	8.1. Status of Marine conservation 8.2. Activities • Restoration and rehabilitation • Artificial reefs • Marine protected areas (MPAs) 8.3. Management examples

Literature

Compulsory

[1] Lecture note

[2] Duarte, C.M. (2009). Marine Ecology. EOLSS Publications, 474pp. https://books.google.com.vn/books?id=yGGSCwAAQBAJ&printsec=frontcover&hl=vi&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Recommended:

[1] Kaiser, M. J., Attrill, M. J., Jennings, S., Thomas, D. N., Barnes, D. K. A., Brierley, A. S., Graham, N. A. J., Hiddink, J. G., Howell, K., & Kaartokallio, H. (2020). Marine Ecology: Processes, Systems, and Impacts. (3 ed.) Oxford University Press. https://books.google.com.vn/books?id=RX_4DwAAQBAJ&printsec=frontcover&dq=marine+ecology&hl=en&sa=X&redir_esc=y#v=onepage&q=marine%20ecology&f=false

[2] Townsend, D.W. 2012. Oceanography and Marine Biology: An Introduction to Marine Science. Sinauer.

[3] Castro P, Michael E, Huber D 2015. Marine Biology. 10th. McGraw-Hill Education. ISBN: 9780078023064.

[4] Mitra A, Zaman S 2017. Basics of Marine and Estuarine Ecology. Springer. ISBN: 9788132227052

[5] Vũ Công Tạng. Cơ sở sinh thái học. Tái bản lần 2. NXB. Giáo dục.

[6] Odum, 1978. Cơ sở sinh thái học. MXB. Đại học và Trung học.

Course workload

The table below summarizes course workload distribution:

Activities	Learning outcomes	Assessment	Estimated workload (hours)
In-class activities (45 hours)			
Lectures	Understanding the ecological principles, ecological characteristics and processes in marine ecosystems	Class participation	15
Moderated in-class discussions	Understanding the basic knowledge of effect of humans on marine ecosystem changes and its biogeographic contingencies	Class participation and preparedness for discussions	10
In-class assignments, homework assignment	Improve the ability to collect, analyse and interpret marine ecological information	Class participation and preparedness for assignments	10
Reading and discussion of assigned papers for preparation for lectures	Develop the teamwork ability and individual oral communications skills through seminars	Class participation, creative and active contribution to discussion	10
Independent work (80 hours)			
Home work and Exercise	Preparing the group assessment with the concern topics of marine ecosystems	Quality of group assignments	80

Total			***125***

Course Assignments
Course assignments will constitute a multi-part project:

- Assignment #1 - (Home work)
- Assignment #2 - (Home work)

Assignment #1: will help students understand how environmental factors impact marine organism and their interaction.

Assignment #2: will help students understand the role of marine organism groups in the foodweb and food chain; How to find the way to use the marine sources.

Grading
The students' performance will be based on the following:

Assessment

- Progress assessment (40%):
  - Class participate (10%)
  - Homework (30%)

- Final assessment (60%):

Evaluation

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