TEACHING MODULES INFORMATION
EMJMD WACOMA (academic year 2020/21)

1.	**Module Title:** Modeling physical-biological processes
2.	**Module Code:** (not necessary yet)
3.	**Maximum Number of Students:** 22
4.	**Total ECTS Credits:** 2 ECTS
5.	**Month:** Mar-Jun
6.	**Notional Learning Hours (Please fill a number in box)**: **(a) Contact Time - e.g in the classroom, or fieldwork** **(b) Private Study - reading time, preparing and taking assessments** **Format of Teaching:** Lectures 9 Hours (a) Laboratories or Practicals 6 Hours Other (computer workshops) Hours Other (tutorials) Hours **Teaching Strategy:** Students will be introduced to numerical models used for studies on ocean circulation at global and regional scales, as well as to the main ecosystem modelling systems.
7.	**Convener:** Ana Machado Irene Laiz
8.	**Institution:** University of Lisbon University of Cadiz
9.	**Level (Please tick Y):** Master
10.	**Language(s) of Tuition**: English
11.	**Pre-requisites:** Students should have a basic knowledge background on numerical modelling, ocean currents and marine ecosystems.
12.	**Co-requisites:** None

13.	**Programme(s) for which module is core:** Erasmus Mundus Joint Master Degree in Water and Coastal Management (WACOMA)
14.	**Module Description - The Purpose or Aims:** The main objectives of this course are to teach students the basic principles of - Ocean circulation numerical modelling - Biogeochemical modelling - Physical-biological coupled models - Lagrangian Transport models
15.	**Learning Outcomes:** At the end of this module students should know the different types of ocean models available, understand their differences and be able to identify an appropriate numerical model for a particular problem.

16.	**Summary of Course Content:**
	
	- Introduction to ocean circulation models:
	  o Earth system models (ESM)
	  o *Oceanic General Circulation Models* (OGCM)
	  o *Regional Ocean Models*
	  o Coastal Ocean Models
	- Introduction to the modelling of marine ecosystems:
	  o Chemical-biological processes
	  o Simple plankton models for the ocean: the NPZD Fasham model
	  o Complex ecosystem models: The Biogeochemical Flux Model (BFM)
	- Physical-biological coupled models

17.	**Key Skills Taught:** - Ocean circulation models - Ecosystem models - Physical-biological coupled models
18.	**Assessment Methods:** Written exam on the contents shown during the lessons.

19.	**Assessment Criteria:** A successful candidate should have or be able to do the following: ***Threshold*** A basic understanding of the appropriate science and modelling approach and a reasonable understanding of the model results and their implications. ***Good*** A good understanding of the science and correct model results which are presented and interpreted to a good standard, with some reference to independent literature data and results. ***Excellent*** A good to excellent understanding of the science and correct model results which are presented and interpreted to a high standard, with plenty of references used for comparisons and to critically evaluate the results.
20.	**Resource Implications of Proposal and Proposed Solutions**: ***Core texts*** Cushman-Roisin, B., Beckers, J.M. (2012). Introduction to Geophysical Fluid Dynamics: Physical and Numerical Aspects. Academic Press, Amsterdam, 828 pp. Fasham, M.J R.; Ducklow, H.W.; McKelvie, S.M. (1990). A nitrogen-based model of plankton dynamics in the oceanic mixed layer. Journal of Marine Research, 48(3), pp. 591-639. Fennel, W., Neumann, T. (2015). Introduction to the Modelling of Marine Ecosystems, Volume 72, 372 pp. Elsevier Science Eds. eBook ISBN: 9780444634153, Hardcover ISBN: 9780444633637 Shchepetkin, A.F., McWilliams, J.C. (2005). The regional oceanic modeling system (ROMS): a split-explicit, free-surface, topography-following-coordinate oceanic model. Ocean Modelling, 9, 347–404, http://dx.doi.org/10.1016/j.ocemod. 2004.08.002. **Specific Resource Implications for Students**:
21.	**Does this module replace existing provision? If so, please indicate modules to be replaced:** The module fits in the area of: “Environmental Impacts and Management”
22.	**Start Date:** First year, second semester

23.	**Is it intended that the module be available every year?** Yes