TEACHING MODULES INFORMATION
EMJMD WACOMA (academic year 2018/19)

1.	**Module Title:** Land reclamation and drainage effect and feedback with water freshening and salinization
2.	**Module Code:** (not necessary yet)
3.	**Maximum Number of Students:** No limit
4.	**Total ECTS Credits:** 2 ECTS
5.	**Month:** First year, second semester
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 14 Hours (a) Laboratories or Practicals Hours Other (computer workshops) Hours Other (tutorials) Hours Other (private study) 36 Hours (b) **Teaching Strategy:** Lectures – 14 Workshops – Tutorials –
7.	**Convener:** Paolo Ciavola
8.	**Institution:** University of Ferrara
9.	**Level:** Master Degree
10.	**Language(s) of Tuition**: English
11.	**Pre-requisites:** (if any) None
12.	**Co-requisites:** (if any) 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 purpose of the module is to provide the students with a basic understanding of the impact of land reclamation on water circulation in estuarine and lagoon environments. Land reclamation in low-lying deltaic areas is paired with the construction of pumping stations as well as systems of drainage. In the current context of climate change, the decrease of freshwater resources poses the problem that the position of the salt-water wedge in estuaries and river mouths will move inland. Where land reclamation takes place, local subsidence is observed due to soil compaction, often exacerbated by groundwater pumping. The case studies will be based on examples from of the Emilia-Romagna region in Italy and in particular the Po Delta and the adjacent territories. Other case studies provided will be the Scheldte Estuary in the Netherlands and the Humber Estuary in UK.
15.	**Learning Outcomes:** The students will learn the basic knowledge on land reclamation and how it can affect estuaries, deltas and lagoons, and nearby freshwater systems. An overview of the general concepts of estuarine circulation will be provided. The general concepts will be further explained through examples from micro, meso- and macro-tidal areas. The students will also understand how estuarine and delta management plans are fundamental to counteract the effect of soil compaction and how good practices, with a long-term perspective, are necessary to mitigate the impact of changes of salinity of coastal water bodies.
16.	**Summary of Course Content:** The course will include a first part with the definition of the processes in estuarine, deltaic and lagoon environments (estuarine circulation; type of estuaries; type of deltas; coastal lagoons; type of reclamation; construction of drainage systems of canals; stratigraphy of terrains in reclaimed areas). Then the case study of the Emilia-Romagna region will be presented with examples from the Po Delta and the Comacchio lagoon. The case study of the Humber Estuary (UK) will be discussed to assess how reclamation has changed circulation if water masses during the last 200 years. Finally, the Scheldte Estuary (NL) will be examined considering undergoing mitigation activities like managed retreat and polder recreation.
17.	**Key Skills Taught:** The students will acquire different skills spacing from geomorphology to water management in deltaic and estuarine areas. The first and most important skill is the capacity to have a comprehensive view of the problem from the processes (water circulation, salt wedge formation). The students will learn how to deal with water drainage in conditions when excessive rainfall and/or storm surges may lead to management decisions.

18.	**Assessment Methods:** The students will have to answer to twenty multiple-choice questions.
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**: (Recommended Bibliography: compulsory, optional, other sources of information) Brown, J., Colling, A., Park, D., Phillips, J., Rothery, D., & Wright, J. (1989). Waves, tides and shallow-water processes. Chapter 6. Open University Cencini, C. (1998). Physical processes and human activities in the evolution of the Po delta, Italy. *Journal of Coastal Research*, 775-793. Edwards, A. M. C., & Winn, P. S. J. (2006). The Humber Estuary, Eastern England: Strategic planning of flood defences and habitats. *Marine Pollution Bulletin*, *53*(1-4), 165-174. Vroon, J. (1994). Hydrodynamic characteristics of the Oosterschelde in recent decades. In The Oosterschelde Estuary (The Netherlands): a Case-Study of a Changing Ecosystem (pp. 17-27). Springer, Dordrecht. **Specific Resource Implications for Students**: None
21.	**Does this module replace existing provision? If so, please indicate modules to be replaced:** The module fits in the area of “Geochemistry”

22.	**Start Date:** First year, second semester
23.	**Is it intended that the module be available every year?** Probably