**Coastal Engineering**

**(4 ECTS)**

42 contact hours; 46 praxis; 40 student workload

**Syllabus**

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| --- | --- | --- | --- | --- | --- | --- |
| Discipline’s code | Discipline’s title |  | | | Number of ECTS | SWST  Self-work of student with teacher in hours |
| Lect. | Pract. | Lab. |
| CMU-14 | Coastal enginering | 42 | 26 | 20 | 4 |  |

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| Academic presentation of the course | **Aim of course:**  The course aims to familiarize students with informations such as:  - Overviews about environmental coastal engineering applications  -Experimental Hydrodynamics and its Impact on Bathing Areas  -Softwares and applications (MIKE, )  - Maritime applications (ArcGIS batimetry)  - Emergency situations applications (ArcGIS)  Students should have knowledge about:   * the processes that affect ocean waves from deep water towards the coast * How we obtain the statistical data for ocean waves from measurements and / or data based on weather observations and wave calculations * Water level and water level changes along the coasts * Descriptive statistics and extreme value estimation in relation to coastal engineering in general and waves in particular * The relationship between waves, currents and sediment transport / erosion * Practical calculations of erosion * Coastal Dynamics * Numerical methods for the calculation of large-scale wave propagation * Numerical wave models for near-field wave modeling and wave load estimation * Understanding of when to use which numerical wave model * Estimation of design wave heights and wave loads for coastal and marine structures.   **As a result of studying the discipline**, students should be able to:   * Calculate the effect varying bottom topography, breakwater openings and similar has on waves * Calculate sea state parameters (wave height, wave period, water levels), both in the short term and long-term perspective * Describe measurement systems for measuring waves * Calculating the tidal currents and sand transport in a harbor entrance * Assess the bedforms and their impact on sand transport under different wave and current conditions * Propose and evaluate measures to protect beaches from erosion due to waves and currents * Use the open-source spectral wave model * Use the open-source wave model for shallow water wave conditions and sediment transport * Use the open-source wave model for deep water wave conditions |
| Prerequisites | Fluids Mechanics, Statistics, Hydraulics, ECLD, Mathematics, Physics, Marine Civil engineering |
| Post requisites | Water management, environmental risk, modelling with different open-source wave model |
| Information resources | Literature:  1.Panaitescu m., Panaitescu F.V., Anton I.A., Advanced Hydrodinamics (Hidrodinamica avansata), Nautica Publishing House, Constanta, 2019.  2. Panaitescu F.V., Theoretical and experimental treatment of BLACK SEA waves .Monograph (Tratarea teoretica si experimentala a valurilor in Marea Neagra. Monografie), Nautica publishing House Constanta, 2016.  3. Panaitescu Mariana- Hydraulic modelling and evaluation of surface waters with  environmental risk (Modelarea hidraulicã şi evaluarea apelor de suprafaţa cu risc de mediu), Nautica Publish House, Constanta, 2016  4. Panaitescu, M., Panaitescu, F.V., Hydraulics. Theories and applications (Hidraulică. Teorie si aplicatii), Nautica Publish House, Constanta, 2011.  5. \*\*\* Hydro-Informatics, Modelling tools MIKE 11, Part 1-Introduction, IHE 2001-2003.  6. Aupoix, B. Eddy Viscosity Subgrid Scale Models for Homogeneous Turbulence, in Macroscopic Modelling of Turbulent Flow, Lecture Notes in Physics, Proc. Sophie-Antipolis, France. (1984)  7. Kofoed-Hansen, H., Slot, P., Sorensen, O.R., Fuchs, J., Combined numerical and physical modelling of seiching in exposed new marina. In proc. 27 th Coastal Eng., pp.3600-3614, (2001).  8. Leonard, A. Energy Cascades in Large-Eddy Simulations of Turbulent Fluid Flows, Advances in Geophysics, 18, (1974), pp 237-247.  9. \*\*\*Bulletin on risk assessment: Risk assessment as an aid to dam safety management. I.C.O.L.D., 102 p.,1999  10. Panaitescu Mariana, Panaitescu Fanel-Viorel, Fluids Mechanics and Hidraulic Machines for Environmental engineering, vol. 1-Fluids Mechanics, vol.2-Hidraulic machines (Mecanica Fluidelor si Masini Hidraulice pentru Ingineria mediului), Nautica Publishing House, Constanta, 2016.  11. Sorensen, O., Sorensen, L.S., Boussinesq type modelling using an unstructured finite element technique,in Proc. 27th Coastal eng. Conf., pp.190-202, (2001).  12. Sorensen, O., Schaffer, H.A., Sorensen, L.S., Boussinesq type modelling using an unstructured finite element technique, Coastal Eng. 50, pp.181-198, (2004).  13.Wang, J.D. Numerical Modelling of Bay Circulation, The Sea, Ocean Engineering Science, 9, Part B, Chapter 32, pp. 1033-1067, ( 1990).  13. Panaitescu Fanel-Viorel, Panaitescu Mariana, Anton Iulia-alina, Voicu Ionut, Introduction in ArcGis. Lab guide (Introducere in ArcGis. Indrumar de laborator), Nautica Publishing House Constanta, 2019.  14. Bălteanu, D., Driga B., Cheval S., Chendeş V., Dumitrascu M., Ciupitu D., Sistem informaţional pentru studiul dezastrelor naturale, Academia Romana, 2016.  14. Wadsworth, Treweek, Geographical Information Systems for Ecology, Longman Publ. House, 1999  15. Branza, L., Aplicatie in ArcGIS, Bilant de mediu Oil terminal Constanta, 2018  Internet-resources:  <https://www.ntnu.edu/studies/courses/TBA4270#tab=omEmnet>  <https://www.planning.org/planning/2021/spring/three-movies-that-can-help-us-combat-climate-change/>  <https://www.climaterealityproject.org/sites/climaterealityproject.org/files/Soil%20Health%20and%20Climate%20Change.pdf>  <https://www.pbs.org/independentlens/blog/earth-day-watch-list-17-new-films-about-sustainability-climate-change/>  <https://www.youtube.com/watch?v=b6fHA9R2cKI>  <http://www.creeaza.com/tehnologie/comunicatii/Introducere-in-ARGIS-Concepte-438.php>  <https://gisro.wordpress.com/2013/03/07/introducere-in-gis/>  <http://www.ecomagazin.ro/sisteme-informatice-de-supraveghere-a-mediului/>  [https://www.google.com/search?q=%E2%80%9ECum+lucreaz%C4%83+GIS?%E2%80%9D&tbm=isch&source=iu&ictx=1&fir=147SpskrXBWRFM%253A%252CEvsc1jfVD1c3rM%252C\_&usg=AI4\_kTkdbbdI9bl1tU10MAH1tWXvLzTLA&sa=X&ved=2ahUKEwimi\_WKm4ngAhVO-qQKHUQ5CKEQ9QEwBHoECAMQBg #imgrc=0gt-iSXrN\_q\_kM](https://www.google.com/search?q=%E2%80%9ECum+lucreaz%C4%83+GIS?%E2%80%9D&tbm=isch&source=iu&ictx=1&fir=147SpskrXBWRFM%253A%252CEvsc1jfVD1c3rM%252C_&usg=AI4_kTkdbbdI9bl1tU10MAH1tWXvLzTLA&sa=X&ved=2ahUKEwimi_WKm4ngAhVO-qQKHUQ5CKEQ9QEwBHoECAMQBg%20#imgrc=0gt-iSXrN_q_kM):  [https://www.google.com/search?q=%E2%80%9ECum+lucreaz%C4%83+GIS?%E2%80%9D&tbm=isch&source=iu&ictx=1&fir=147SpskrXBWRFM%253A%252CEvsc1jfVD1c3rM%252C\_&usg=AI4\_-kTkdbbdI9bl1tU10MAH1tWXvLzTLA&sa=X&ved=2ah UKEwimi\_WKm4ngAhVOqQKHUQ5CKEQ9QEwBHoECAMQBg#imgrc= DA82zTaNYMVtiM](https://www.google.com/search?q=%E2%80%9ECum+lucreaz%C4%83+GIS?%E2%80%9D&tbm=isch&source=iu&ictx=1&fir=147SpskrXBWRFM%253A%252CEvsc1jfVD1c3rM%252C_&usg=AI4_-kTkdbbdI9bl1tU10MAH1tWXvLzTLA&sa=X&ved=2ah%20UKEwimi_WKm4ngAhVOqQKHUQ5CKEQ9QEwBHoECAMQBg#imgrc= DA82zTaNYMVtiM):  https://support.office.com/ro-ro/article/contorizarea-valorilor-unice-din-dubluri-8d9a69b3-b867-490e-82e0-a929fbc1e273  <https://docs.qgis.org/2.8/ro/docs/gentle_gis_introduction/vector_attribute_data.html>  <http://desktop.arcgis.com/en/arcmap/latest/extensions/maritime-bathymetry/what-is-arcgis-for-maritime-bathymetry.htm>  <https://www.esri.com/en-us/arcgis/products/arcgis-for-maritime-charting/overview>  <https://www.esri.com/en-us/arcgis/products/arcgis-for-maritime-server>  [http://www.esri.ro/~/media/esri-romania/Files/Pdfs/ ADMINISTRATIE %20%20%20151.pdf](http://www.esri.ro/~/media/esri-romania/Files/Pdfs/%20ADMINISTRATIE%20%20%20%20151.pdf)  <http://solutions.arcgis.com/emergency-management/preparedness/manage-community-events/>  <http://solutions.arcgis.com/water/water-delivery/>  <http://solutions.arcgis.com/gallery/#s=0&md=industries:water%3ASewer%20Collection>  <http://esri.com/en/arcgis/products/arcgis-pro/> |

**Calendar (schedule) the implementation of the course content:**

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| --- | --- | --- | --- |
| **Week / date** | **Topic title (lectures, practical classes, Independent work of students, IWS)** | **Number of hours** | **Maximum score** |
| 1 | 2 | 3 | 4 |
| 1 | **Lecture 1.** COASTAL AREAS:  Definition and importance. importance of coastal areas in ECA.  Climate change in coastal areas. | 4 | 10 |
| Practical class 1. Social dimension of coastal areas. The economic dimension of coastal areas. Natural capital of coastal areas | 2 | 10 |
|  | Lab 1.Description for different cases studies of coastal areas. | 2 | 10 |
|  | **Self-work** of student with teacher: SWST.  *Theme and form of task*: ECA coastlines: weather , climate changes, sinergies, stressors, erossions, damages. | 10 | 10 |
| 2 | **Lecture 2.** Exposure and sensitivity in areas of coastlines. | 4 | 10 |
| Practical class 2. Synergies between climate change and current stresses in the sea: eutrophication, human health, stressors, errosions, economic damages. | 2 | 10 |
|  | Lab 2. How can us combat climate change. Movies. | 2 | 10 |
|  | **Self-work** of student with teacher: SWST.  *Theme and form of task*:  Soil Health and the Climate Crisis  Coral reefs (Chasing coral)  Marine litters | 6 | 10 |
| 3 | **Lecture 3.** Adaptive strategies and capacity in the context of coastal areas. | 4 | 10 |
| Practical class 3.Adaptive strategies. Protect, acomodate, retreat and reviesed spatial planning. | 2 | 10 |
| Lab 3. Case study:the factors and the constraints affecting adaptive capacity . | 4 | 10 |
| **Self-work** of student with teacher: SWST.  *Theme and form of task*:  The elements of vulnerability in coastal areas.  Adaptive capacity-case study. | 6 | 10 |
| 4 | **Lecture 4.** General elements regarding the wave phenomenon. | 4 | 10 |
|  | Practical class 4. The genesis of waves. | 2 | 10 |
|  | Lab 4. The geometric elements of the wave. | 2 |  |
|  | **Self-work** of student with teacher: SWST.  *Theme and form of task*: Technical solutions for capturing waves. Case studies. | 6 | 10 |
| 5 | **Lecture 5.** Theoretical treatment of the wave phenomenon. Mathematical treatment of the wave phenomenon in the liquid hypothesis perfectly incompressible. Obtaining the trajectory of the movement. Calculation of wave parameters: pulsation, wavelength, speed propagation. Calculation of the theoretical potential energy of sine waves. Calculation of theoretical kinetic energy. Calculation of the theoretical power of waves. Raising the average sea level due to waves. The critical depth of the basin in which the waves act. | 10 | 10 |
|  | Practical class 5. Evaluation of the energy potential of the waves based on the hydrometeorological regime. Introduction in modeling software (eg. MIKE). | 4 | 10 |
|  | Lab 5. Initiation in the use of waves software tools. | 8 |  |
|  | **Self-work** of student with teacher: SWST.  *Theme and form of task*: Software applications. | 10 | 10 |
| 6 | **Lecture 6.** Environmental coastal engineering applications.software applications.  . | 6 | 10 |
|  | Practical class 6 . Intelligent specialization in the field of energy | 2 | 10 |
|  | Lab 6. Experimental Hydrodynamics and its Impact on Bathing Areas | 4 | 10 |
|  | **Self-work** of student with teacher: SWST.  *Theme and form of task*: MIKE Software applications. | 10 | 10 |
| 7 | **Lecture 7.** ArcGis-Introduction and applications in coastal engineering. | 6 | 10 |
|  | Practical class 7. ArcGis-data, working with the map, geographical entities, tables, attributes. | 6 | 10 |
|  | Lab 7. ArcGis maritime applications. | 6 | 10 |
|  | **Self-work** of student with teacher: SWST.  *Theme and form of task*: ArcGis. Case studies | 10 | 10 |