UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Physics of The Sea

2425-1-F7502Q005

Aims

Provide basic knowledge of the physics of the oceans. Show the usefulness of mathematical and physical models for the description and the understanding of geophysical fluid dynamics.

Contents

In the first part of the course fundamental physical properties of the ocean will be introduced. The second part will be basic geophysical fluid dynamics, with the discussion of solutions to approximations relevant for the description of the ocean circulation and waves. In the laboratory sessions, hands on experiments will be presented to better visualise and understand the main topics of the course.

Detailed program

Ocean Physics: Light and sound propagation. Temperature and salinity. Equation of state. Mixed layer and stratification. Tracer distribution. Heat fluxes. Water masses. T-S diagrams.

Oceanic Dynamics: Navier-Stokes equation. Mass conservation. Hydrostatic approximation. Geostrophic flow. Ekman transport. Upwelling and downwelling. Vorticity. Large scale circulation and winds. Subtropical and subpolar gyres. Western boundary currents. Gravity waves. Rossby and Kelvin waves.

Labortatory sessions: Geophysical fluid dynamical experiments.

Prerequisites

Basic math knowledge: arithmetic, algebra, trigonometry, geometry, calculus, vectors.
Basic physics knowledge: kinematics, thermodynamics, dynamics, atomic structure, waves.
Basic knowledge of physical geography: latitude, longitude, planetary orbital motion, Earth rotation, Moon cycle, seasonality.

Teaching form

The class is entirely in English language.

a) 17.5 two-hour lectures, in person, Delivered Didactics

b) 6 two-hour lab activities, in person, Interactive Teaching

Textbook and teaching resource

Vallis “Essential of Atmospheric and Oceanic Dynamics”, Cambridge Univ. Press (2019)

Stewart, “Introduction to Physical Oceanography”, freely available on line.

Marshall and Plumb “Atmosphere, Ocean, and Climate Dynamics”, Academic Press (2008)

Talley et al "Descriptive Physical Oceanography", Elsevier (2011).

Semester

Second

Assessment method

Oral exam: candidates will be asked questions regarding the topics discussed in class. Each student will discuss a couple of topics chosen by the instructors, deciding by him/her-self what mathematical level to use. Attention will be payed to the accuracy of the used language (mathematical or not). Typical duration of the exam is about 15 minutes, but large deviations are possible depending on how the exam evolves. Students who have not been present to at least 75% of the lab sessions will be required to solve a problem set, chosen among those provided on the eleraning web page (solutions are also provided on the elearning web page, students will have to work on them by themselves).

Office hours

Contact the instructor

Sustainable Development Goals

QUALITY EDUCATION