Leon H. Charney
School of
Marine
Sciences
UNIVERSITY
OF HAIFA

Physical oceanography – 2 credits

Course Number: 224.4998

Lecturers: Prof. Smadar Ben-Tabou de-Leon, Dr. Yoav Lehahn

Tutor: Areen Qassem

Lecturers' and Tutor's Contact Information: Prof. Smadar Ben-Tabou de-Leon: email: sben-tab@univ.haifa.ac.il; Dr. Yoav Lehahn: email: ylehahn@univ.haifa.ac.il; Areen Qassem: email: areen.qassem@gmail.com

Course Type: Lecture

Course Level: MSc/ PhD

Prerequisites: No

Course Description:

The course physical of oceanography aims to teach advanced students about the physical properties of ocean water and the physical processes within them, emphasizing the physical aspects that influence marine organisms. The course will discuss external (e.g., sun, earth rotation, winds, etc.) and internal (e.g., temperature and density) factors that drive physical processes in the ocean (stratification, currents, waves, etc.). The common mathematical formalism used to study these processes and get predictions will be introduced and practiced. The course will also describe the connection between physical factors and processes to biological processes and ecological systems.

Topics:

1. Introduction: Motivation to study physical oceanography, geographical context (oceans), length and time scales, physical properties of seawater – temperature, salinity, density and pressure optional – CTD, stratification.
2. Functions, sin/cos, exponent (e), derivative, second derivative, differential equations.
3. Qualitative description of ocean currents I: thermohaline circulation, typical length and time scales, measurement, remote sensing principles.
4. Vertical structure of the water column: Ocean stratification, potential temperature and density, stability of the water column.
5. Scalars & vectors, Cartesian and polar coordinate system, Coordinate system, Mechanics and newton second law.
6. Basic conservation laws in oceanography and the equations of motion including friction and Reynolds.
7. Qualitative description of ocean currents II: wind driven circulation, measurements, advection, Ekman transport and upwelling, transport.
8. Eddy viscosities, wind driven inertial flow in the ocean.
9. Reynolds, Coriolis and Inertial flow, home exercise.
10. Ekman depth and transport and Geostrophic flow.
11. Geostrophic balance and mesoscale eddies, Small scale motion.

12. Geostrophic flow and light in the water.
13. Ekman transport, Geostrophic flow and light.
14. Current topics in physical oceanography.

Requirements: 100% completion of the exercises and 80% attendance in the classes is required for completion of the course.

Grading: Based on exercises and a test: Exercises – 30%, test – 70%.

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