

1. Department, Course Number, Title

ORE 330, Mineral & Energy Resources of the Sea

2. Designation as a Required or Elective Course

Elective

3. Course Catalog Description

Hard material and petroleum origins, exploration and exploitation. Renewable and non-renewable resources distribution. Political and scientific constraints. Pre: 202 or OCN 201, or consent. (Cross-listed as OCN 330)

4. Prerequisites

ORE 202 Ocean Technology—Man in the Sea, or OCN 201 Science of the Sea, or consent

5. Textbooks and/or Other Reading Material

Cronan, D.S. (1999). *Handbook of Marine Mineral Deposits*. CRC Press
Cronan, D.S. (1980). *Underwater Minerals*. London: Academic Press

6. ABET Course Learning Outcomes

Upon successful completion of ORE 330, the student should be able to:

1. Understand the various types of marine minerals, their mode of formation and their importance geologically and economically.
2. Understand the various options for deriving energy from the ocean and the potential advantages and disadvantages of each.
3. Understand the legal, environmental, economic and technical difficulties in extracting minerals and energy from the ocean.

7. Topics Covered

- Peak Everything, Parts I (Population & Fossil Fuels) & II (Minerals)
- Mid-ocean ridges, basins and trenches
- Overview of submarine hydrothermal systems
- Origins of high and low-temperature hydrothermal deposits
- Recycling of ocean crust and the Geostill Concept
- Chemistry of hydrothermal vents and polymetallic sulfides, Parts I & II
- Introduction to Ocean Energy
- Oil and gas deposits; Future oil provinces
- Oil and Gas: Resources & politics of oil & gas, oil spills & oil spill recovery
- Methane hydrates
- OTEC (Ocean thermal energy conversion)
- Wind power
- Wave power
- Current and tidal power
- Energy futures, hydrogen, fuel cells
- Placer deposits

- Fresh water and desalination
- Geology of ferromanganese crusts and nodules
- Chemistry of crusts and chemical variability with age
- Platinum and phosphorite-rich layers: Seawater vs. extraterrestrial sources
- Phosphorites, Parts I & II
- Mining technology for manganese nodules, crusts and sulfides
- Marine minerals development - Legal and environmental issues
- Marine minerals as possible economic deposits, world metal markets

8. Schedule

Two 1.25-hour sessions per week.

9. Contribution of Course to Meeting the Requirements of Criterion 5

Assessment

Assignments (20%)

Class participation (10%)

Midterm and Final exams (70%)

Usage of Engineering Tools and Computers

Matlab and Excel

Contribution to Professional Component

Engineering Science: 3 credits

10. Relationship to Program Outcomes

Program Outcome 1: Broad Education

Program outcome 2 : Basic science, mathematics, & engineering

Program Outcome 6: Problem formulation & solution

Program Outcome 9: Professional issues

Program Outcome 10: Communication skills

Program Outcome 11: Research & contemporary issues

Program Outcome 12: Life-long learning

11. Prepared by

J.C Wiltshire, Spring 2009