

1. Department, Course Number, Title

ORE 678, Marine Mineral Resources Engineering

2. Designation as a Required or Elective Course

Required for Resources track

3. Course Catalog Description

Activities in marine minerals development are examined in a multidisciplinary systems approach involving engineering, Earth and environmental sciences and economics. Pre: Consent

4. Prerequisites

Applied mechanics  
Engineering economics

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  
Herbich, J.B. (1992b). *Handbook of Dredging Engineering*. New York: McGraw-Hill

6. ABET Course Learning Outcomes

The course familiarizes students with the mineral resources of the ocean and the engineering challenges faced to exploit them. Specific course learning outcomes include:

1. Ability to formulate the design issues involved in underwater mining equipment.
2. An understanding of the range and type of ocean mineral deposits.
3. Ability to articulate the environmental, economic and energy issues involved in ocean mineral development

7. Topics Covered

- Introduction to Marine Minerals
- Peak Everything - Running out of Commodities
- Manganese Nodules and Marine Mining
- Deep Sea Mining Technology
- Minerals Processing
- Offshore Oil and Gas
- Oil and Gas Technology, Future Oil Sources and Issues
- Economics of Marine Minerals
- World Metal Markets
- Formation Processes of Polymetallic Sulfides (PMS) on the Ocean Floor: Geology of the Smoker and PMS
- Chemistry of Hydrothermal Vents and Polymetallic Sulfides
- PMS Deposits: From Smoker to an Ore Body
- Case Studies on the Ocean Floor: The Red Sea
- Ferromanganese Crusts, Methane Hydrates, Placers

8. Schedule

Two 1.25-hour sessions per week.

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

Usage of Engineering Tools and Computers

Matlab and Excel

Contribution to Professional Component

Engineering Science: 2 credits

Design: 1 credit

10. Relationship to Program Outcomes

Program Outcome 1: Broad Education

Program outcome 2 : Basic science, mathematics, & engineering

Program Outcome 4: Ocean engineering specialization

Program Outcome 5: Use of latest tools in ocean engineering

Program Outcome 6: Problem formulation & solution

Program Outcome 9: Professional issues

Program Outcome 10: Communication skills

Program Outcome 11: Research & contemporary issues

11. Prepared by

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