1. Course Number and Title
   ORE 603 Oceanography for Ocean Engineers

2. Credit and Hours
   3 credits, two 1.25-hour sessions per week.

3. Instructor
   Eva-Marie Nosal

4. Textbooks
   Textbooks:
   a. R.H. Stewart (2007), An introduction to physical oceanography.
   Reference books:
   b. T. Garrison (2002), Oceanography: An Invitation to Marine Science, Brooks/Cole.
   c. G.L. Pickard and W.J. Emery (1990), Descriptive Physical Oceanography: An Introduction, Butterworth- Heinemann.
   d. S. Pond and G.L. Pickard (1993), Introductory Dynamical Oceanography, Butterworth-Heinemann.
   e. R.J. Urich (1983), Principles of underwater sound, 3rd ed., Peninsula Publishing.

5. Course Information
   a. Course Content: Physical, chemical, biological and geological ocean environments for ocean engineers. Introduction to ocean dynamical processes and general circulation. Ocean measurement techniques, theory of underwater acoustics. Sonar, swath bathymetry, and tomography applications. Pre: consent.
   b. Prerequisites: Differential equations, Fluid mechanics
   c. Designation: ORE required core course

6. Course Goals
   a. To provide the ocean engineering student with an understanding of the ocean environment. The course will provide an overview of the physical, chemical, biological and geological processes that determine the state of the ocean and its dynamics. Topics of discussion will include description of the world's oceans and dynamic processes, introduction to analytical description, circulation and ocean measurement techniques. Theory of underwater acoustics will be examined along with sonar, swath bathymetry and tomography applications.
   b. Upon successful completion of ORE 603, students will be able to:
      i. Identify, describe, and relate the physical processes and dynamics processes associated with surface and deep ocean circulation
      ii. Describe and relate sea-water chemistry, salinity, temperature, pressure, and density
      iii. Summarize the basic principles and implications of plate tectonics and marine sedimentation
      iv. Demonstrate a basic understanding of biological processes and production in the ocean
      v. Explain the key elements associated with air-sea interaction
      vi. Balance oceanic water, heat, and salt budgets
      vii. Demonstrate a basic understanding of sound propagation in the ocean
      viii. Formulate and communicate (in writing and orally) a critical review of a research paper
   c. Program Outcomes:
      i. (1) Fundamentals: (1) understand fundamentals of calculus, physics, chemistry, and partial

differential equations, (2) identify fundamentals relevant to specific applications, (3) implement fundamentals to problem solving

ii. (2) Core Program: (1) Understand core concepts in oceanography including: ocean basins and margins; properties of sea water chemistry; water, salt and heat balance; physical laws and equations of motion; effects of rotation; atmospheric circulation; ocean circulation; biological oceanography, (3) knowledge of underwater acoustics, (3) apply oceanography core content to new problems

iii. (6) Communication: (1) use appropriate language and grammar, (2) be organized, clear and concise, (3) provide visual aids, (4) understand and respond effectively to questions and feedback, (5) cite sources appropriately

iv. (10) Constant learning: (1) identify gaps in student's knowledge, (2) assemble information relevant to a selected research topic, (3) evaluate quality of online and traditional information sources, (4) understand and synthesize new information into knowledge, (5) Apply new knowledge to draw conclusions

7. <u>Topics Covered</u>
   a. Ocean Basins and Margins
   b. Properties of Water / Sea Water Chemistry
   c. Water, Salt and Heat Balance
   d. Physical Laws and Equations of Motion
   e. Effects of Rotation
   f. Atmospheric Circulation
   g. Ocean Circulation
   h. Coastal Oceanography
   i. Biological Oceanography
   j. Instruments and Methods
   k. Underwater Acoustics