1. Department, Course Number, Title

ORE 641, Environmental Fluid Dynamics

2. Designation as a Required or Elective Course
Elective

3. Course Catalog Description
Fluid dynamics for coastal and estuarine environments. Turbulent mixing processes in homogeneous and stratified fluids. Buoyancy driven flows, internal hydraulics, topographic effects and estuarine circulation. Spill and pollutant dispersal. Pre: 603 or consent.

4. Prerequisites
Differential equations
Fluid mechanics

5. Textbooks and/or Other Reading Material

Textbook: None

Reference books:
1. *Estuaries: A Physical Introduction*, K.R. Dyer, John Wiley & Sons, 1997
2. *Mixing in Inland and Coastal Waters*, H.S. Fischer, E.J. List, R.C.Y. Koh, J. Imberger and N. Brooks, Academic Press Inc., 1979
3. *A First Course in Turbulence*, H. Tennekes and J.L. Lumley, The MIT Press, 1972
4. *Buoyancy Effects in Fluids*, J.S. Turner, Cambridge University Press, 1973

6. ABET Course Learning Outcomes
(Course objectives) This course aims to provide ocean and resources engineering students with an understanding of the fundamental dynamic processes at work in the coastal marine environment. It examines how these processes lead to the transport and dispersal of properties such as salinity, temperature, pollutants and nutrients.

7. Topics Covered
1. Transport processes / Diffusion
2. Fluid dynamics review
3. Turbulence
   a. Turbulent shear layers
   b. Stratified shear layers
   c. Boundary layers
4. Buoyancy driven turbulent flow
5. Downslope currents
6. Plumes and jets
7. Internal waves
8. Internal hydraulics
9. Estuarine hydrodynamics

10. Pollutant and spill dispersal

8. Class/laboratory schedule
   Two 1.25-hour sessions per week.

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

   Assessment
   Individual presentations 10%
   In class discussion 15%
   Homework 40%
   Midterm 15%
   Final Exam 20%

   Usage of Engineering Tools and Computers
   Matlab

   Contribution to Professional Component
   Engineering Science: 3 credits

10. Relationship to Program Outcomes
    Program Outcome 2: Basic science, mathematics, & engineering
    Program Outcome 5: Use of latest tools in ocean engineering
    Program Outcome 6: Problem formulation & solution

11. Prepared by and date of preparation
    G. Pawlak, Spring 2009