

**University Of California, Berkeley**  
**Department of Mechanical Engineering**

**ME 168: Mechanics of Offshore Systems (3 units)**

**Undergraduate Elective**

*Syllabus*

**CATALOG DESCRIPTION**

This course covers major aspects of Offshore Engineering including ocean environment, loads on offshore structures, cables and mooring, underwater acoustics and arctic operations.

**COURSE PREREQUISITES**

ME 106, ME C85, and ME 165 (recommended).

**TEXTBOOK(S) AND/OR OTHER REQUIRED MATERIAL**

Recommended references:

1. Wave Forces on Offshore Structures by Turgut 'Sarp' Sarpkaya (Feb 26, 2010)
2. Dynamics of Offshore Structures by James F. Wilson
3. Offshore Structure Modeling (Advanced Series on Ocean Engineering ; V. 9) by Subrata Kumar Chakrabarti (Feb 21, 1994)
4. Construction of Marine and Offshore Structures, Third Edition by Ben C. Gerwick Jr (Mar 5, 2007)
5. Sea Loads on Ships and Offshore Structures (Cambridge Ocean Technology Series) by O. Faltinsen
6. Offshore Structures: Design, Construction and Maintenance, Mohamed A. El-Reedy
7. Underwater Acoustics: Analysis, Design and Performance of Sonar by Richard P. Hodges (Jul 19, 2010)
8. An Introduction to Underwater Acoustics: Principles and Applications (Springer Praxis Books / Geophysical Sciences) Xavier Lurton
9. Fundamentals of Ship Acoustics by Harrison T. Loeser (Jan 6, 1999)
10. Underwater Acoustic Modeling and Simulation Third edition by Paul C. Etter
11. Arctic Offshore Engineering by Andrew Palmer and Ken Croasdale (Dec 4, 2012)

**COURSE OBJECTIVES**

To provide a basic to intermediate level of treatment of engineering systems that operate in coastal, offshore, and arctic environment. Students will acquire an understanding of the unique and essential character of the marine fields and the analysis tools to handle the engineering aspects of them.

**DESIRED COURSE OUTCOMES**

By the conclusion of the course, students should be able to:

- Formulate and solve governing equation for an offshore structure under the action of incident waves
- Assess relative importance of each contributing factor in the design of an offshore system
- Analyze and design mooring systems for offshore systems

- Formulate and solve for linear underwater acoustic problems
- Assess and analyze operations in Arctic environments

## **TOPICS COVERED**

Review of ocean wave environment, governing equations, mutual interactions of offshore structures and oceanic waves, cables and moorings, underwater Acoustics, Arctic marine structures.

## **CLASS/LABORATORY SCHEDULE**

3-hr lecture per week, 1 hour discussion section

## **CONTRIBUTION OF THE COURSE TO MEETING THE PROFESSIONAL COMPONENT**

Students will be able to formulate, solve and discuss problems related to offshore structures when subjected to the wave forces in an open sea.

## **RELATIONSHIP OF THE COURSE TO ABET PROGRAM OUTCOMES**

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (d) an ability to function on multi-disciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

## **ASSESSMENT OF STUDENT PROGRESS TOWARD COURSE OBJECTIVES**

30% Midterm exam  
40% Final exam  
30% Homework.

## **PERSON(S) WHO PREPARED THIS DESCRIPTION**

Professor Reza Alam, 05/17/2013

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**ABBREVIATED TRANSCRIPT TITLE (19 SPACES MAXIMUM):** MECH OFFSHORE-SYS  
**TIE CODE:** LECS  
**GRADING:** Letter  
**SEMESTER OFFERED:** Fall  
**COURSES THAT WILL RESTRICT CREDIT:** None  
**INSTRUCTORS:** Alam  
**DURATION OF COURSE:** 15 Weeks  
**EST. TOTAL NUMBER OF REQUIRED HRS OF STUDENT WORK PER WEEK:** 9  
**IS COURSE REPEATABLE FOR CREDIT?** No  
**CROSSLIST:** None

ME168

## Mechanics of Offshore Systems

Day	Date	Lecture	Topic
Thursday	8/29/2013	1	Characteristics of Offshore and Coastal Systems, Maritime Operations
Tuesday	9/3/2013	2	Linear Potential Theory, A Review,
Thursday	9/5/2013	3	The equation of motion and Response Amplitude Operator, Review,
Tuesday	9/10/2013	4	Shallow water hydrodynamics and Bathymetry effects,
Thursday	9/12/2013	5	Loads on Offshore Structures,
Tuesday	9/17/2013	6	Vibratin of Continuous Systems- Introduction
Thursday	9/19/2013	7	Cantilever beams, Beam vibration & natural modes,
Tuesday	9/24/2013	8	Transient response,
Thursday	9/26/2013	9	Wind and Current loads on offshore structures,
Tuesday	10/1/2013	10	Vortex induced vibration,
Thursday	10/3/2013	11	Extreme environment, Rogue Waves
Tuesday	10/8/2013	12	Cables & mooring: Basic catenary in air,
Thursday	10/10/2013	13	Catenary in water,
Tuesday	10/15/2013	14	Mooring systems configuration and design,
Thursday	10/17/2013	15	Wave-drift forces,
Tuesday	10/22/2013	16	Low frequency damping,
Thursday	10/24/2013	17	Dynamic Positioning
Tuesday	10/29/2013	18	Numerical Modeling of Offshore Structures with Mooring
Thursday	10/31/2013	19	Numerical Modeling of Offshore Structure with Mooring (Cont.)
Tuesday	11/5/2013	20	Underwater Acoustics: Introduction to Sonar (Acoustic Waves, Doppler shift, intensity and Decibels)
Thursday	11/7/2013	21	Intro to Acoustics (cont.)+ Sonar Equations,
Tuesday	11/12/2013	22	Transducers, Directionality and Arrays,
Thursday	11/14/2013	23	Transducers, Directionality and Arrays (Cont.)
Tuesday	11/19/2013	24	Ambient noise,
Thursday	11/21/2013	25	Underwater guidance and navigation,
Tuesday	11/26/2013	26	Arctic Marine Structures,
Thursday	11/28/2013		
Tuesday	12/3/2013	27	Ice structure, Ice load on structures,
Thursday	12/5/2013	28	Wave-ice interactions,