1. **Course Number and Title**  
ORE 612 Dynamics of Ocean Structures

2. **Credit and Hours**  
Credits, two 3-hour sessions per week

3. **Instructor**  
Deniz Gedikli

4. **Textbooks**  
Textbooks: None  
References:  

5. **Course Information**  
a. Course content: Response of floating platforms and vessels to wave action, spectral analysis in sea keeping. Frequency and time domain analyses of rigid body motions in six degrees of freedom.  
b. Prerequisite:  
   i. ORE 411 or consent.  
   ii. Co-requisite ORE 609 or consent.  
c. Designation: Offshore Option

6. **Course Goal**  
Upon satisfactory completion of the course, the student should:  
a. Understand the wave forces which act on offshore structures  
b. Be able to calculate these forces for various situations  
c. Have a sound background in the mathematical tools involved  
d. Have a basic understanding of offshore structure kinematics

7. **Topics covered**  
a. Linear Oscillator – One Degree of Freedom  
b. Free Vibration with Linear Damping  
   i. Motion of a Floating Body in Quiescent Water  
c. Forced Vibration – Steady State Oscillation (Part I)  
   i. Motion of a Floating Body in Regular Waves  
d. Forced Vibration – Transient and Nonperiodic Vibrations  
   i. Review of Laplace Transform  
   ii. Unit Step Function – Indicial Response  
   iii. Unit Impulse Function – Impulsive Response
iv. Pulsed Sinusoidal Excitation
v. Arbitrary Excitation
e. Forced Vibration – Steady State Oscillation (Part II)
   i. Review of Fourier Transforms
   ii. Impulsive Response and Complex Frequency Operator
f. Time Domain Solutions
g. Time Domain Solution of Equations of Motion Containing Frequency Dependent Coefficients
   i. Connection between Frequency Domain and Time Domain
   ii. Time Domain Description – Linear Equations of Motion
   iii. Hydrodynamic Force on Body Making Arbitrary Oscillations in Originally Calm Water
h. Motion of Floating Bodies
  i. Kinematics of Rigid Bodies
  ii. Linear Momentum of a Rigid Body
  iii. Angular Momentum
  iv. Dynamics of a Rigid Body
     Linear Motions
     Rotational Motions
  The General Six Scalar Equations of Motion
  The Linearized Equations of Motion for a Body with a Plane of Symmetry
i. Hydrodynamic Coefficients and Wave Excitation – 3D Source Distribution
  i. Review of Ideal Fluid Theory
  ii. Green’s Theorem and Distribution of Singularities
  iii. Hydrodynamic Pressure Forces
  iv. Force on a Moving Body in an Unbounded Fluid
  v. General Properties of Added Mass Coefficients
  vi. The Body-Mass Force
  vii. Linear Diffraction Theory Equations of Motions
  viii. Non-Linear Equations of Motion – Frequency Domain
  ix. Non-Linear Restoration Function – Ritz-Galerkin Method
  x. Forced Oscillation with Non-Linear Damping and Non-Linear Restoration
  xi. General Types of Non-Linear Damping and Linear Restoration
j. Two Moving Body Interaction Problem
  i. Van Oortmerssen (1979)
  ii. Cummins (1962)
  iii. Greeson (1997)
k. Ship Motions in Irregular Seas