Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE461	WAVE HYDRODYNAMICS AND CAOSTAL ENGINEERING	3-0-0-3	2016

Pre-requisite : CE206 : Fluid Mechanics II

Course objectives:

1. To introduce the fundamentals in ocean wave mechanics and coastal engineering.
2. To impart knowledge and comprehension over the basic aspects of wave hydrodynamics.
3. To equip the students with the state-of-the-art in coastal zone protection.

Syllabus :

Linear Wave Theory-Derivation for Velocity potential, Wave kinematics, Wave kinetics, Wave Power. Wave propagation in Shallow water region. Wave pressure, Wave forces-Morrison equation, Froude –Krylov force, Linear diffraction theory. Coastal process, Coastal protection works, Environmental parameters.

Expected Outcomes:

- The students will be able to develop skills and knowledge to solve the issues connected with ocean wave interaction with offshore and coastal features.

Text Book :

Dominic Reeve, Andrew Chadwick, Chris Fleming. Coastal Engineering : Processes, Theory and Design Practice, CRC Press, 2015

References:

1. Narashimhan, S.and S. Kathiroli(Ed.), Harbour and Coastal Engineering(Indian Scenario), -NIOT Chennai, 2002
2. US Army Corps of Engineers, Coastal Engineering Manual, 2002
3. US Army Corps of Engineers, Shore Protection Manual, Coastal Engineering Research Centre, Washington, 1984.
4. V.Sundar, Ocean wave Mechanics Applications in Marine Structures, Ane Book Pvt Ltd, New Delhi, 2016.
5. William Kamphuis ; Introduction to Coastal Engineering and Management, World Scientific, 2002.

COURSE PLAN

Module	Contents	Hours	Sem. Exam Marks %
I	A brief overview on fundamental principles of fluid mechanics (No questions for examination). Characteristics of a regular ocean wave (Wave length, Wave period and wave celerity).Difference between regular and random waves, Linear Wave theory-Assumptions. Boundary Conditions-Kinematic free surface, Dynamic free	7	15

	surface. Separable solution of Laplace Equation for velocity potential. Dispersion equation derivation, Dispersion relationship in different water depth conditions (Shallow, intermediate and deep). Worked out exercises.		
II	Particle velocity and acceleration under wave transport. Particle Displacement. Orbital motion of water particles at different water depth. Derivation for potential energy and kinetic energy. Worked out exercises. Energy flux/Wave power, Derivation for group celerity.	7	15
FIRST INTERNAL EXAMINATION			
III	Wave propagation in shallow water- Wave shoaling –Derivation for shoaling coefficient- Worked out exercises. Wave refraction-analytical expression for refraction coefficient, Combined effect of shoaling and refraction-worked out exercises. Wave diffraction –its significance in harbor planning. Wave reflection-effect of surf similarity parameter. Wave breaking- in shallow water, Breaker types. Wave set up and set down, Wave run up.	6	15
IV	Pressure field under progressive wave, Pressure response factor, Dynamic pressure component. Wave force formulation, force regimes. Wave forces on slender circular members-Morrison Equation. Worked out exercises.	6	15
SECOND INTERNAL EXAMINATION			
V	Discussion on Wave Forces on large bodies, Froude –Krylov force-general theory. Diffraction theory-Linear diffraction problem-general theory and solution formulation. Wave forces on coastal structures-A brief overview on small amplitude wave theories – only at conceptual level. Wave force by Hirori Formula, Sainflou formula, Nagai Formula. Discussion only on Goda Formula.	8	20
VI	Introduction to beach and Coastal process-terms describing beach profile. Coastal erosion process-Natural and man made factors. Shallow water effects in coastal erosion. Long shore sediment transport and its effects on coastal process (only discussion). Near shore currents, cross shore sediment transport. Coastal protection (Only discussion, design is not expected)-important factors to be considered. Coastal protection methods-shore parallel and shore perpendicular structures, beach nourishment, Environmental parameters considered in design.	8	20
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN (End semester examination)

Maximum Marks :100 **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V & VI : 2 questions out of 3 questions carrying 20 marks each

Note : 1.Each part should have at least one question from each module

2.Each question can have a maximum of 4 subdivisions (a, b, c, d)