Indian Institute of Technology
Course Details Report

Course No: OE5170

Course Name: Ocean Acoustics

Course Type:

Theory

Description:

: The objective of the course is to enable students gain a thorough understanding of the generation, propagation and scattering of acoustic waves in the ocean, based on formulation and analysis of acoustic wave equation governing propagation of sound in a medium and on principles governing reflection and transmission of waves across air-water and sea-bottom interfaces, including effects of density and sound-speed variability with depth.

Course Content:

Introduction. Physical properties of seawater. Effects of density, salinity and temperature on sound speed. Underwater sound channels (USC). Surface and bottom effects. Ambient noise. Sound Propagation: Wave equation;Helmholtz equation; Lighthill's acoustic analogy; Point source and plane wave solutions; Refraction of sound waves; Snell's Law; Caustics and shadow zones; Ray theory. Reflection and Transmission: Changes at an interface between two immiscible liquids. Transmission of sound from air to water and vice versa; Reflection from ocean bottom; Propagation of sound in shallow water. Sound propagation in Underwater Sound Channel (USC): Ray theory for USC; Munk's model; Acoustic field as sum of normal modes; Analysis based on a parabolic equation, Scattering of Sound: Scattering at rough boundary surfaces; Method of small perturbation (MSP); Scattering of sound by surface waves and internal waves. Sound Radiation: Generation of sound by marine vehicles and offshore platforms. Acoustics Applications: Remote sensing; Underwater communication; Sonar principle and use; Acoustic tomography; Geophysical seismic exploration.

Text Books:

Kinsler, Frey, Coppens and Sanders, "Fundamentals of Acoustics", 4th edition, 1999.

Reference Books:

1. L. M. Brekhovskikh and Yu. P. Lysanov, "Fundamentals of Ocean Acoustics," Springer Series on Wave Phenomena (Edited by L.B. Felsen), Springer-Verlag, 1982.
2. Class and lecture notes