



Indian Institute of Technology

Course Details Report

Course No: OE5580

Course Name: Impact Mechanics for marine structures

Course Type:

Theory

Description:

To introduce M.Tech (Dual Degree)/M.Tech (OE) students to the fundamentals and advanced concepts in the area of Impact Mechanics for Marine floating and submerged Structures. Broadly, it will help them in understanding the behaviour of materials and components subjected to impact, penetration and blast loading. Overall, the idea is to inculcate the attitude of research and design in their minds. The proposed topics have been arranged with help of experts from shipyard and well known academicians.

Course Content:

Review of continuum mechanics, jump conditions, plasticity theory, damage and failure theory, shock and wave propagation in both solid and fluid media using Eulerian, Lagrangian and Arbitrary Lagrangian-Eulerian frameworks, and the high pressure and high-rate response of materials. Fluid-structure interactions for marine structures. Design and analysis concepts for stiffened plate-shell structures

Advanced materials mechanics: Constitutive relations and fracture criteria for materials subjected to dynamic loads; Analysis of large plastic deformations; damage and fracture criteria. Concepts of strain rate effects and equations of state for relevant applications.

Impact and energy absorption: Energy absorption in materials and components; Models for penetration and blast loading; and Modelling of materials for large plastic deformations. Elastic and plastic impacts, elastic and plastic stress-wave theory.

Penetration mechanics: Empirical, analytical and numerical methods and blast loading against marine structures (empirical, analytical, and numerical methods).

Application-oriented examples: Effect of impact and explosion on stiffened plate structures; Estimation of crushing and the impact impulse in ship-to-ship and ship-to-offshore structures' collisions.

Text Books:

1. James D. Walker (2021), "Modern Impact and Penetration Mechanics", Cambridge University Press, UK.
2. C. L. Rao, V. Naranmurthy, and K. R. Y. Sinha (2016), "Applied Impact Mechanics", Ane Books, India.
3. W. J. Stronge (2000), "Impact Mechanics", Cambridge University Press, UK.

Reference Books:

1. OTO 00053 (2000), "Collision Resistance of Ship Shaped Structures to Side Impact", MSL Engineering Limited, UK.
2. Woisin G. (1988), "Instantaneous loss of energy with unsymmetrical ship collisions", Vol. 40. Schiff and Hafen, 1988; 50-5.
3. Pawlowski M. (1995), "Energy loss in ship's collisions", Centrum Techniki Okretowej, Poland, 1995.
International Maritime Organization (IMO). IMO Resolutions A265A, 1974.
4. Pedersen PT, Jensen JJ. (1991), "Ship impact analysis for bottom supported offshore structures", Advances in marine structures II. Elsevier Applied Sciences, Amsterdam, 1991; 276-95.