

Wave simulation, measurement and analysis - Web course

COURSE OUTLINE

Introduction to random waves
- statistical & spectral analysis;

**Laboratory wave simulation,
measurement & analysis:**
Wave groups, Breaking waves,
Stokes 2nd order & Shallow
water waves such as Cnoidal
and Solitary waves. Wavelet
transforms and principal
component analysis.

Univariate and multivariate
spectral analysis of signals;
Hilbert transform; Phase
diagram; Bi-spectral analysis of
nonlinear waves;

Multi-Directional waves -
simulation and analysis using
Fourier Method, MLM & MEM -
single point measurement and
array of gauges; Reflection,
refraction and diffraction of
directional waves.

Data buoys types - directional
wave measurement.

Radar - LIDAR & SAR
techniques of directional wave
measurement.

Wind-wave Modelling: Third
generation Wind - Wave
modeling for wave hind-casting
and forecasting;

**Nearshore wave propagation
in phase** -averaging and
phase-resolving modes using
industry Softwares; Wave
tracing; Computational
evaluation of diffracted wave on
large bodies using industry
software; Boussinesq
approximation.

COURSE DETAIL

Topic	No. of hours



NP-TEL

NPTEL

<http://nptel.iitm.ac.in>

Ocean Engineering

Pre-requisites:

Wave Hydrodynamics.

Additional Reading:

1. <http://mitocw.udsm.ac.tz/OcwWeb/Mechanical-Engineering/2-24Spring-2002/LectureNotes/index.htm>
2. <http://mitocw.udsm.ac.tz/NR/rdonlyres/70ED612B-49ED-478D-A3EA-5ADC75128B99/0/lect4.pdf>

Hyperlinks:

1. <http://userwww.sfsu.edu/~efc/classes/biol710/timeseries/TimeSeriesAnalysis.html>
2. http://folk.ntnu.no/oivarn/hercules_ntnu/LWTcourse/partB/2randomwaves/random.htm
3. <http://paos.colorado.edu/research/wavelets/>
4. <http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=00061546>

Coordinators:

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Introduction to random waves - statistical & spectral analysis	5	
Laboratory wave simulation, measurement & analysis: Wave groups, Breaking waves, Stokes 2nd order & Shallow water waves such as Cnoidal and Solitary waves.	6	
Univariate and multivariate spectral analysis of signals; Hilbert transform; Phase diagram; Bi-spectral analysis of nonlinear waves. Wavelet transforms and principal component analysis.	8	
Multi-Directional waves - simulation and analysis using Fourier Method, MLM & MEM - single point measurement and array of gauges; Reflection, refraction and diffraction of directional waves.	6	
Data buoys types - directional wave measurement Radar – LIDAR & SAR techniques of directional wave measurement.	2	
Wind-wave Modelling: Third generation Wind – Wave modeling for wave hind-casting and forecasting; Nearshore wave propagation in phase-averaging and phase-resolving modes using industry Softwares; Wave tracing;	9	
Computational evaluation of diffracted wave on large bodies using	4	

industry software; Boussinesq approximation.	
Total	40

References:

1. Dean, R.G. and Dalrymple, R.A. 1990. *Water Wave Mechanics for Engineers and Scientists*. World Scientific Publishing Company, ISBN: 9810204205.
2. Newland, D.E. 1996. *An Introduction to Random Vibrations, Spectral & Wavelet Analysis*. [Prentice Hall](#).
3. [Pengzhi Lin](#). 2008. *Numerical Modelling of Water Waves*. [Taylor & Francis Group](#).
4. Komen, G.J., Cavaleri, L., Donelan, M., Hasselmann, K., Hasselman, S. and Janssen, M. 1994.. *Dynamics and Modelling of Ocean Waves*.
5. Goda, Y. 1985. *Random Seas and Design of Maritime Structures*. University of Tokyo Press, Japan.
6. Hudspeth, R.T. 2006. *Waves and wave forces on coastal and ocean structures*. Advanced Series on Ocean Engineering - Vol. 21. World Scientific.