**OE5320: NONLINEAR PROBLEMS IN OCEAN ENGINEERING**

**Course Content:**

Nonlinearity – definition and sources; examples of offshore systems involving nonlinear analysis Degrees of freedom, Generalized coordinates, Behaviour of Dynamical systems about Equilibrium points, System with non-linearity, Conservative and Non-conservative systems – Nonlinear Stiffness and damping.- Duffing, van-der-Pol equation Analytical solutions – Perturbation solution Forced oscillations – Sub and super harmonic motions; Chaotic motions. Systems with periodic coefficients- Mathieu's equations, Floquet's theory, Stability; Moorings, Nonlinear wave theories and wave loading; Responses of structures excited by Second-Order Effects; Nonlinear wave loading on large floating systems, Random response and statistical analysis.

**Text Books:**

1. Nonlinear Methods in Offshore Engineering by **SK. Chakrabarti**
2. Stochastic Dynamics of Marine Structures by **Arvid Naess, Torgeir Moan**
3. Nonlinear Dynamics and Chaos by **SH. Strogatz**
4. Nonlinear Oscillations by **Ali H. Nayfeh and DT Mook**

**Reference Books:**

1. Nonlinear Dynamics and Chaos by **J. M. T. Thompson and H. B. Stewart**
2. Hydrodynamics of Offshore Structures by **SK Chakrabarti**
3. Wave Forces on Offshore Structures by **T Sarpkaya**
4. Fluid Structure Interaction in Offshore Engineering by **S. K. Chakrabarti**
5. An Introduction to Random Vibrations, Spectral & Wavelet Analysis by **D. E. Newland**
6. Ocean Waves: The Stochastic Approach by **Michel K. Ochi**
7. Random Data: Analysis and Measurement Procedures by **Julius S. Bendat and Allan G. Piersol**

**Prerequisite:**