OE6020: MESHFREE METHODS APPLIED TO HYDRODYNAMICS

Course Content:

Numerical modelling; Basics of fluid mechanics; NS – Eulerian and Lagrangian Formulations; Free surface and Body boundary conditions; Time split algorithms; Strong and Weak forms; Weighted Residual methods. Overview of mesh based methods and meshfree methods; Basic techniques; Categories of meshfree methods; shape function constructions – Issues; SPH; Point Interpolations; Moving least square method; Shepard Functions; Error estimations; Support domain and Influence domain; Weight functions; Meshfree Integrations; Computational Cost; Conservation and Convergence. Meshfree methods based on Global weak form – EFG; Meshfree methods based on Local weak form – MLPG; Smoothed Particle Hydrodynamics; Moving Particle Semi-Implicit method; Essential Boundary conditions – Issues; Turbulence – Sub-particle scale; Meshfree methods applied to fluid dynamics problem; Matrix formulations and solution methods in meshfree methods; application to floating bodies, coastal engineering.

Text Books:

1. **G.R. Liu (2006),** "Mesh free methods: Moving beyond the finite element method", CRC Press, Taylor and Francis, US.

Reference Books:

1. **J. Anderson** (1995), "Computational Fluid Dynamics: The basics with applications", McGraw-Hill, USA.
2. **Li H and Mulay SS** (2013), "Meshless methods and their numerical properties", CRC Press, Taylor and Francis, US.
3. **S.N. Atluri** (2004), "The Meshless method (MLPG) for domain and BIE discretizations", Tech Science Press.
4. **G.R. Liu and M.B. Liu** (2003), "Smoothed Particle Hydrodynamics", World Scientific, Singapore. (also available as E-book)

Prerequisite:

Consent of teacher