# CE6500 – Unsteady Open Channel Flow

**Credit Distribution:** C:9 L:3 T:0 P:0 E:0 O:6 TH:0

**Course Type:** Theory

**Description:** Development of unsteady open channel flow, basic equation of unsteady flows, Numerical methods of solution of the unsteady flow equation: method of characteristics, finite difference schemes – Leap Frog scheme, Lax Wandroff $2^{nd}$ order scheme, Maccormack scheme, explicit and implicit schemes, simplified equations of unsteady flows, weak solution. Transport of materials. Choice of models and case studies. Simulation of overland flows, surges in power canals, dam-break problem. Finite element method applications to surges and flood computation.

**Course Content:** Introduction: Steady flow, unsteady flow; open channel flow vs. pipe flow; importance for design and operation. Transient pipe flow; Rigid Column theory; wave propagation; differential equations for water hammer; solution by characteristic method; modeling of different boundary conditions; transients in pumping systems; transients in networks. Transient control in piping systems, Air chambers; Pressure regulating valves; Transients in hydro-electric schemes; surge tanks: Types of surge tanks, governing equations, stability of surge tanks. Transients in open channels, Causes; different of waves; shallow water theory; surge propagation; derivation of Saint-Venant equations; kinematic and diffusion routing. Methods of solution for Saint-Venant equations. Method of characteristics; finite-difference methods: explicit (Lax Diffusive; McCormack) and implicit (Preismann) schemes, consistency, convergence and stability; boundary conditions; advanced shock capturing schemes. Softwares for one and two dimensional flows. Discussions and applications of open source softwares available for transient flow analysis.

**Text Books:** NIL

**Reference Books:** NIL

**Prerequisite:** NIL