Computational Hydraulics

Course Code	Credit Hours
CE-875	3+0

Course Description

To equip the students with the knowledge of various numerical techniques for fluid flow simulation with hands on experience of popular codes to solve laboratory and field scale problems in Hydraulics.

Textbook:

1. Introduction to codes for the solution of SWE. SRH-2D, Basement, HEC-RAS.
2. Maksimovic and M. Radojkovic (Ed.), Computational Modelling and Experimental Methods in M. B. Abbott & D. R. Basco, Computational Fluid Dynamics: An introduction for Engineers, Longman, 1989.
3. E. F. Toro, Riemann Solvers and Numerical Methods for Fluid Dynamics, Springer-Verteg, 1997.
4. M. B. Abbott & D. R. Basco, Computational Fluid Dynamics, John Wiley & Sons, 1990.

Reference Book:

1. Joel H. Ferziger and MilovanPeric, Computational Methods for Fluid Dynamics, Springer-Verteg, 1999.
2. Van Keer and Brebbia, Moving Boundaries IV: Computational Modeling of Free and Moving Boundary Problems, Computational Mechanics, 1997.C. Hydraulics, E & FN Spon, 1989.
3. Khalid Mahmood &Yevjevich (Ed.), Unsteady Open Channel Flow, Water Resources Publications, Fort Collins.
4. M. H. Chaudhry, Applied Hydraulic Transients (2nd Edition), VenNostrend Reinhold, N. Y., 1988.

Prerequisites. Nil

ASSESSMENT SYSTEM FOR THEORY

Quizzes	10%
Assignments	10%
Mid Terms	30%
End Semester Exam	50%

Teaching Plan

Week No	Topics\Learning outcome
1-3	The Description of Fluid Flow. Derivation of governing equations of flow. The Navier-Stokes equations. The shallow water (SWE) /Saint Venant equations.
4-6	The finite difference, finite element and finite volume methods for the solution of governing partial differential equations (PDE)
7-8	The diffusion equations & its numerical solution. The 1D linear advection equation.
9	**Mid Semester Exam**
10-13	The advection diffusion equation. The unsteady diffusion and advection diffusion equation. Solution methods for SWE. The method of characteristics. Mcmormack method; box scheme.
14-16	Turbulence in free surface flow. Turbulence closure; Boussinesque approximation. The algebraic model, mixing length model, one-equation and two-equations model, Reynold stress model. LES and DNS.
17-18	**End Semester Exam**