Department: Civil & Environmental Engineering **Division: Civil engineering**
Level and Major: Graduate - Hydraulic structures and Water Engineering

---

Course Title: Computational hydraulics **Number of Credits: 3**
Prerequisite (Corequisite): Structural analysis (I), Concrete Technology Lecturer: -

---

Course Topic

- Part one: theoretical foundation of numerical methods
- Necessity and application of numerical methods and mathematical modeling in hydraulic engineering and water structures
- Explain the different stages of numerical modeling(understanding the physics of the problem,the governing equation ,dismantling the physical environment ,dismantling the governing equations numerical solution steps ,applying initial and boundary conditions ,evaluation ,calibration)
- Types of partial differential equations and their classification (elliptical ,parabolic ,hyperbolic)
- Introduction and comparison of the basics of different numerical methods(limited difference control volume, limited volume ,limited part ,boundary part specification method, spectral methods)
- Numerical solution of elliptical equations(Laplace and Poisson equation)methods of dismantling and solution of spatial derivative of order two(zhagovi, Gauss-sidel ,linear-broom, integrated solution)boundary conditions
- Numerica lsolutio no fparabolic equations) diffusion equatio(nmethods o fdismantling and solving tim echanges) precise-implied-cronk nicolso-ngeneral sem iimplici-t ADI(boundar yconditions
- Numerical solution of hyperbolic equations(transfer equation and wave equation)methods of dismantling and solution of spatial derivative of order one(general methods –more careful methods like McCormac)boundary conditions
- Explain the accuracy ,consistency, stability and convergence of numerical methods
- Part two: application of numerical methods in computational hydraulics
- Types of dismantling river environment and dam reservoir(one_ dimensional and two-dimensional, ordinary and shifted meshing ,Cartesian coordinates and curved coordinates)
- Numerical solution of one-dimensional flow in rivers and canals (governing equations of saint-Venant, permanent flow and flood in the river ,methods of solution)
- Numerical solution of flow in penstock and water hammer with blue hammer(governing equations, permanent and non-permanent flow, user conditions , methods of solution)
- Numerical solution of transfer equations-diffusion in one –dimensional mode(explain the equations for the movement of particles and solutes and insoluble oily substances and heat , modeling of sediment and erosion, modeling of contaminant substances

Course Description:
Reading Sources:
Course Goals and objectives:
Evaluation:
Course topics:
The course aims t:o