UNIVERSITY OF CALIFORNIA, DAVIS
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

COURSE: WATER RESOURCES SIMULATION (ECI 146)

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SYLLABUS OF ECI 146, WATER RESOURCES SIMULATION

1. **Introduction.**
   1.a) Importance of water resources (01/11/18).
   1.b) Definition of simulation. Evaluation of simulation of water resources as a tool for management (01/11/18).
   1.c) Classification of modeling approximations: 0D, 1D, 2D and 3D (01/16/18).
   1.d) The Moody chart (01/16/18).

2. **Basic concepts on numerical techniques. Part I.**
   2.a) Types of equations (01/16/18).
   2.b) Iterative solution of non-linear equations by the methods of Newton-Raphson, bisection, Regula-Falsi, and iteration of a point (01/16-01/18/18).
   2.c) Advantages and disadvantages of each method (01/18/18).
   2.d) Computation of normal-flow depth (01/23/18).

3. **Basic concepts on numerical techniques. Part II.**
   3.a) Introductory ideas on the solution of ordinary differential equations by finite-difference methods. Stability of the numerical solution (01/25/18).
   3.b) Approximation of first and higher-order derivatives by finite differences. Explicit and implicit solutions (01/25/18).
   3.c) Euler and Runge-Kutta methods (01/30/18).
   3.d) Consistency, convergence and stability of numerical solutions (01/30/18).
   3.e) Computations of backwater curves by finite differences (01/30/18).
   3.f) Conceptual description of the finite-element method (FEM) (02/01/18).

4. **Zero-order models for water-quality simulations in water bodies.**
   4.a) Phenomena associated with pollution in water bodies: Advection and diffusion (02/01/18).
   4.b) Reactor models for the simulation of the time evolution of phosphorus and nitrogen in lakes. Lake model (02/01/18).
   4.c) A simple sedimentation-resuspension model for rivers (02/01/18).

5. **Simulation of water retention in ponds and reservoirs.**
   5.a) Methods for flood-wave routing in reservoirs and rivers (02/06/18).

5.b) Hydrologic reservoir modeling (02/06/18).
5.c) Reservoir flood management (02/08/18).

6. One-dimensional hydrodynamic models.

6.a) *Hydrologic* river routing. Muskingum method (02/13/18)
6.b) Derivation of the one-dimensional equations of fluid motion in rivers (02/13-02/15/18).
6.c) *Hydraulic* river routing (02/15/18).
6.d) Kinematic wave model. Kinematic wave model for overland flow (02/15/18).
6.e) Different numerical schemes used to solve the flow equations (02/20/18).
6.f) Muskingum-Cunge method (02/22/18).

7. One-dimensional models of water quality in streams.

7.a) Basic equations of one-dimensional advection-diffusion (dispersion) of pollutants (02/27/18).
7.b) Transport models including reactive terms (03/01/18).
7.c) Transport models for organic matter in streams (03/01/18).
7.d) Transport models for suspended sediment in streams (03/06/18).
7.e) Transport models to assess pollution in water bodies (03/08/18).
7.f) Numerical schemes to deal with transport equations of the advection-diffusion type (03/08/18).

8. Introduction to two- and three-dimensional, flow and water-quality models.

8.a) Basic concepts and models most used in practice (03/13/18).
8.b) Description of case studies (03/13/18).
8.c) Shallow-water equations (03/13/18).

Dates quoted here might be subject to change.