UNIVERSITY OF CALIFORNIA, DAVIS
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

COURSE: WATER RESOURCES SIMULATION (ECI 146)

INSTRUCTOR: ***Fabián A. Bombardelli***
(fabianbombardelli2@gmail.com, bmbrdll@yahoo.com, fabombardelli@ucdavis.edu)
OFFICE: 3105, Ghausi Hall (former Engineering III building)
Class: Tuesdays and Thursdays-10:30 to 11:50 AM (119 Wellman)
Computer lab: Fridays-8:00 AM to 8:50 AM and 2:10 PM to 3 (Ghausi Hall 2030)

SYLLABUS OF ECI 146, WATER RESOURCES SIMULATION

Dates are tentative

1. **Introduction.**

    1.a) Importance of water resources (01/08/19).

    1.b) Definition of simulation. Evaluation of simulation of water resources as a tool for management (01/10/19).

    1.c) Classification of modeling approximations: 0D, 1D, 2D and 3D (01/10/19).

    1.d) The Moody chart (01/15/19).

2. **Basic concepts on numerical techniques. Part I.**

    2.a) Types of equations (01/15/19).

    2.b) Iterative solution of non-linear equations by the methods of Newton-Raphson, bisection, Regula-Falsi, and iteration of a point (01/15-01/17/19).

    2.c) Advantages and disadvantages of each method (01/17/19).

    2.d) Computation of normal-flow depth (01/17/19).

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 (01/24/19).

    3.b) Approximation of first and higher-order derivatives by finite differences. Explicit and implicit solutions (01/24/19).

    3.c) Euler and Runge-Kutta methods (01/29/19).

    3.d) Consistency, convergence and stability of numerical solutions (01/29/19).

    3.e) Computations of backwater curves by finite differences (01/29/19).

    3.f) Conceptual description of the finite-element method (FEM) (01/31/19).

4. **Zero-order models for water-quality simulations in water bodies.**

    4.a) Phenomena associated with pollution in water bodies: Advection and diffusion (01/31/19).

    4.b) Reactor models for the simulation of the time evolution of phosphorus and nitrogen in lakes. Lake model (01/31/19).

    4.c) A simple sedimentation-resuspension model for rivers (01/31/19).

5. Simulation of water retention in ponds and reservoirs.

5.a) Methods for flood-wave routing in reservoirs and rivers (02/05/19).

5.b) Hydrologic reservoir modeling (02/05/19).

5.c) Reservoir flood management (02/07/19).

6. One-dimensional hydrodynamic models.

6.a) *Hydrologic* river routing. Muskingum method (02/12/19)

6.b) Derivation of the one-dimensional equations of fluid motion in rivers (02/12-02/19/19).

6.c) *Hydraulic* river routing (02/19/19).

6.d) Kinematic wave model. Kinematic wave model for overland flow (02/19/19).

6.e) Different numerical schemes used to solve the flow equations (02/19/19).

6.f) Muskingum-Cunge method (02/21/19).

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

7.a) Basic equations of one-dimensional advection-diffusion (dispersion) of pollutants (02/26/19).

7.b) Transport models including reactive terms (02/28/19).

7.c) Transport models for organic matter in streams (02/28/19).

7.d) Transport models for suspended sediment in streams (03/05/19).

7.e) Transport models to assess pollution in water bodies (03/07/19).

7.f) Numerical schemes to deal with transport equations of the advection-diffusion type (03/07/19).

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

8.a) Basic concepts and models most used in practice (03/12/19).

8.b) Description of case studies (03/12/19).

8.c) Shallow-water equations (03/12/19).