CEE 693
Environmental Hydraulics

Catalog data:	20-CEE-693. Environmental Hydraulics. 3 ug./gr. cr. Water and contaminant transport in pipe networks; advection, dispersion and reaction of soluble substances; unsteady gradually varied open channel flow in rivers and through detention ponds.
Prerequisites:	CEE 493, 494, 543 or graduate standing
Textbook:	Chin (2000) *Water Resources Engineering*, Prentice Hall plus assigned reading material from refereed literature
References:	Fischer et al, (1979) *Mixing in Inland and Coastal Waters*, Acad Press. White (1994) *Fluid Mechanics*, McGraw-Hill. www.epa.gov/ORD/NRMRL/wswrd/epanet.html (EPANET) www.wrc-hec.usace.army.mil (HEC-RAS)
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Goals:	To understand and analyze the movement of water and dissolved contaminants in pressurized conduits and in open channels subject to unsteady, nonuniform and random forcing conditions.
Lecture or lab topics:	1. Review of conservation laws (mass, energy, momentum) (3 class) 2. Resistance to flow (2 class) 3. Flow in water distribution systems (2 class) 4. Quality in water distribution systems (2 class) 5. Mass transport in laminar and turbulent flow (2 class) 6. Advection-dispersion equation (1 class) 7. Steady uniform open channel flow (2 class) 8. Unsteady-nonuniform open channel flow (4 class) 9. Mass routing with Runge-Kutta method (1 class) 10. Exam (1 class)
Computer usage:	Two interactive programs are demonstrated in class and used in the homework. HEC-RAS is used to analyze water surface profiles along a constricted flood plain. EPANET is used to evaluate water flow and water quality in a distribution system. EPANET is also used to assess the vulnerability of the pipe network to contamination by deliberate intrusion. In addition, students write a program to execute a 4^{th} -order Runge-Kutta method for routing an unsteady storm pollutograph through a detention pond.
ABET criterion 3:	a, e, g, k
ABET criterion 8:	a, b, e, f
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