

Water Resource Engineering Thrust Area (2018-19)

Civil Engineering ATE (Approved Technical Elective) Advising Sheet

Each CE student is required to take 24 units of ATE (Approved Technical Electives). These electives can be any CE/ENVE 400/500 level coursework (not required as part of the major), some CE/ENVE 300 level course work, or any one of a list of preapproved elective options from outside CE/ENVE (check the department website). This freedom in the CE program allows students to specialize in a particular area (or two or three...) or develop a little deeper in all areas. Please consider your choices in the context of graduate school, the area in which you would like to practice, or the breadth of knowledge you would like to attain. Below is the **Thrust Area** for Water Resource Engineering to consider as you plan your Senior Year. **NOTE:** You may mix and match ATE's in any way you like that works best for you, your schedule, and we encourage you to seek faculty advising to help map your final choices.

It is suggested that students interested in water resources engineering take at least three courses from the list below. The courses are loosely grouped into three areas that are **NOT** mutually exclusive. Students are free and encouraged to choose from the different areas to diversify their knowledge base. The graduate level CE 53X courses will provide depth in the thrust areas as listed below. ENVE 438 and BRAE 532 complement water resources courses in the Civil Engineering program. The ATEs will prepare undergraduate civil engineering students to be successful as practicing engineers or in graduate school in the Trust Area. **Courses in the WRE Thrust Area require prior completion of CE336 and CE337.**

	Fall	Winter	Spring
Surface Water	CE 433 (4) - Open Channel Hydraulics	CE 431 (4) - Coastal Hydraulics I	
	CE 435 (4) - Engineering Hydrology	CE 536 (4) - Computer Apps in WRE with Geographic Info Systems (GIS)	
		CE 539 (4) - Environmental Hydraulics	
Ground Water	CE 434 (4) - Ground Water Hydraulics and Hydrology (Course offered Fall and Spring - NOT Winter)		
		CE 537 ¹ (4) - Groundwater Contamination	BRAE 532 ³ (4) - Water Wells and Pumps
Urban Water	CE 440 (4) - Hydraulics Systems Engineering		CE 538 (4) - Urban Water Systems
			CE 533 (4) - Advanced Water Resources
	ENVE 438 ² (4) - Waste and Wastewater Treatment Design (Course offered Fall and Spring - NOT Winter)		

1. Requires CE 434 as a prerequisite
2. Requires ENVE 331 as a prerequisite
3. See instructor for permission number and prerequisite waiver

CE 431. Coastal Hydraulics I. 4 units - Prerequisite: ME 341 or ENVE 264.

Waves and their characteristics, types of waves, water wave theories, orbital velocities, refraction of waves, wave diffraction, wave reflection, application of linear theory to wave forces on cylindrical structures, submerged pipelines and vertical flat barriers (sea walls), wave uprush, rubble mound breakwaters. 4 lectures.

CE 433. Open Channel Hydraulics. 4 units - Prerequisite: CE 336.

Analysis and characteristics of flow in open channels; critical flows; uniform flow; gradually varied flow; channel design problems, channel transitions and controls. Rapidly varied flow; hydraulic jump and energy dissipaters. Unsteady flows, waves and wave propagation, flood routing. Applications of numerical methods in hydraulic engineering. 4 lectures.

CE 434. Groundwater Hydraulics and Hydrology. 4 units - Prerequisite: CE 336.

Differential equations of groundwater flow, Darcy's Law, solutions of the steady and unsteady flow, differential equations for confined and unconfined flows. Pumping test design. Groundwater models, leaky aquifers. Saltwater intrusion. 4 lectures.

CE 435. Engineering Hydrology. 4 units - Prerequisite: CE 336.

Analysis of hydrologic cycle components such as precipitation, infiltration and evaporation. Rainfall-runoff analysis to determine peak flows and runoff hydrographs. Hydrologic river and reservoir routings and their applications for flood plain management. Application of frequency analysis methods to determine design rainfalls and design flows. 4 lectures.

CE 440. Hydraulic Systems Engineering. 4 units - Prerequisite: CE 336.

Water and wastewater flows. Design of water distribution systems, transmission and storage reservoirs, wastewater collection systems, and storm water systems. Pumps and pump systems, flow measurements. Water sources for municipal supply. 3 lectures, 1 laboratory.

CE 533. Advanced Water Resources Engineering. 4 units - Prerequisite: CE 336 or graduate standing.

Matrix and simulation methods in hydrology, statistical studies in hydrology and their applications to civil engineering problems. Generalized hydrologic characteristics. Hydrologic simulation, computer applications, urban and small watershed hydrology, macroscopic and microscopic approach. Storm water management models. Hydrologic design. 4 lectures.

CE 536. Computer Applications in Water Resources with Geographic Info Systems (GIS). 4 units - Prerequisite: CE 336 or graduate standing.

Modeling, design and analysis of water, wastewater, stormwater systems. Integration of water resource systems with Geographic Information Systems (GIS). 3 lectures, 1 laboratory.

CE 537. Groundwater Contamination. 4 units - Prerequisite: CE 434. Corequisite: ENVE 331.

Sources and types of groundwater contamination, contamination transport mechanisms. Sorption and other chemical reactions. Numerical modeling of contaminant transport. Nonaqueous phase liquids. Groundwater remediation and design. 4 lectures.

CE 538. Urban Water Systems. 4 units - Prerequisite: CE 440 or graduate standing.

Integration of water delivery, wastewater collection, drainage systems, and associated treatment components in urbanizing areas. Relationships between surface and groundwater elements of water sources and disposal. Use of current design models to quantify the benefits of non-traditional options. 4 lectures.

CE 539. Environmental Hydraulics. 4 units - Prerequisite: CE 336 or graduate standing.

Application of fluid mechanics principles to environmental flows. Emphasis on advection, dispersion, stratification and mixing effects. Stratified flows, turbulent jets and plumes, wastewater and thermal diffusers, cooling ponds and channels, control of environmental problems. 4 lectures.

BRAE 532. Water Wells and Pumps. 4 units - Prerequisite: BRAE 312 or BRAE 340 or CE 336 or ME 341.

Water well drilling, design, and development. Pump characteristics and system head. Series and parallel operation. Design of pump intakes. Variable speed electric drives and engines. Pump testing. 3 lectures, 1 laboratory.

ENVE 438. Water and Wastewater Treatment Design. 3 units - Prerequisite: ENVE 331 and ME 341 or ENVE 264.

Theory and design of facilities for physical and chemical treatment of water and wastewater, biological treatment of wastewater, and treatment and disposal of sludge. 3 lectures.