

Hydrology and Hydraulics Courses in the School of Civil Engineering at Purdue University

The below is a list of commonly-taught courses in the Hydraulics and Hydrology program at Purdue University. All information is subject to change.

Additional water-related courses can be found at the Purdue Water Community [web page](#) as well as the [Ecological Sciences and Engineering web page](#).

CE 340 – Hydraulics

Usually offered Fall, Spring

Description Fluid properties; hydrostatics; kinematics and dynamics of fluid flows; conservation of mass, energy, and momentum; flows in pipes and open channels. Formal laboratory experiments

Pre/Corequisites [C E 298](#). Authorized equivalent courses or consent of instructor may be used in satisfying course pre- and co-requisites.

CE 343 – Hydraulics Lab

Usually offered Fall, Spring

Description The laboratory covers basic concepts in analysis of experimental data and methods in hydraulic measurements. A variety of simple laboratory experiments illustrating the principles of hydraulics are performed.

Pre/Corequisites C E 340. Authorized equivalent courses or consent of instructor may be used in satisfying course pre- and co-requisites.

CE 440 – Urban Hydraulics

Usually offered Fall

Description Sources and distribution of water in urban environment, including surface reservoir requirements, utilization of groundwater, and distribution systems. Analysis of sewer systems and drainage courses for the disposal of both wastewater and storm water. Pumps and lift stations. Urban planning and storm drainage practice.

Pre/Corequisites C E 340. Authorized equivalent courses or consent of instructor may be used in satisfying course pre- and co-requisites.

CE 443 – Introductory Environmental Fluid Mechanics

Usually offered Variable

Description Review of governing equations for fluid flow; Nondimensionalization and

scaling; boundary layer formulation and application to rivers and lakes; water waves and oscillatory flows; flow around objects, drag, and sediment transport; introduction to turbulence; effects of density stratification, including internal waves and estuaries.

Pre/Corequisites Prerequisites: CE340 or equivalent; MA 262.

CE 540 – Open Channel Hydraulics

Usually offered Alternate years

Description Energy and momentum principles, design of open channels for uniform and nonuniform flow, boundary layer and roughness effects, flow over spillways, energy dissipation, flow in channels of nonlinear alignment and nonprismatic section.

Pre/Corequisites C E 340. Authorized equivalent courses or consent of instructor may be used in satisfying course pre- and co-requisites.

CE 542 – Hydrology

Usually offered Spring

Description Meteorology; precipitation; stream flow, evaporation, and transpiration; subsurface flows, well hydraulics; runoff relations and hydrographs; elements of stream flow routing, frequency and duration studies; extreme values statistics applied to flood and drought forecasting; application of hydrologic techniques.

Pre/Corequisites C E 340. Authorized equivalent courses or consent of instructor may be used in satisfying course pre- and co-requisites.

CE 543 – Coastal Engineering

Usually offered As needed

Description An introduction to coastal engineering with emphasis on the interaction between oceanic dynamic processes (waves, currents, and tides) and coastal regions (beaches, harbors, structures, and estuaries) and on the engineering approaches necessary to prevent adverse effects caused by this interaction.

Pre/Corequisites C E 340. Authorized equivalent courses or consent of instructor may be used in satisfying course pre- and co-requisites.

CE 544 – Subsurface Hydrology

Usually offered Fall

Description Basic principles of fluid flow in saturated and unsaturated materials. Darcy's law, well hydraulics, determination of hydraulic properties of aquifers. Infiltration theory. Discussions of artificial recharge, land subsidence,

Pre/Corequisites saltwater intrusion, ground water quality and contamination.
 C E 340. Authorized equivalent courses or consent of instructor may be used in satisfying course pre- and co-requisites.

CE 545 – Sediment Transport Engineering

Usually offered As needed
 Description Sediment properties and the mechanics of sediment transport. Threshold of movement. Riverbed load and suspended load theories. Regime theory and stable channel design. River diversion problems. Erosion. Geomorphologic and water quality aspects.
 Pre/Corequisites A course in hydraulics or fluid mechanics. Authorized equivalent courses or consent of instructor may be used in satisfying course pre- and co-requisites.

CE 546 – Computational River Hydraulics

Usually offered Offered in alternate years.
 Description Use of professional computer programs for the solution of river hydraulics problems. General formulation of energy losses in a river reach. Methods of handling the presence of bridges; software for handling bridges only. Channel modifications. Floodway determination. Flow around islands. River networks analysis.
 Pre/Corequisites CE340, CE343. Authorized equivalent courses or consent of instructor may be used in satisfying course pre- and co-requisites.

CE 547 – Transport Processes in Surface Waters

Usually offered Offered in alternate years
 Description Four main topics are covered: (1) density-stratified two-layer systems in lakes and channels, with applications to mixed-layer growth, oil-spill containment, salinity intrusions, (2) advection-diffusion modeling in channels, including analytical and numerical solutions to steady and unsteady, one- and two-dimensional problems, (3) mechanisms of diffusional transport, including turbulence in channels and longitudinal shear dispersion, and (4) near-field analysis of discharges, including similarity analyses of jets and plumes.
 Pre/Corequisites A course in hydraulics or fluid mechanics. Authorized equivalent courses or consent of instructor may be used in satisfying course pre- and co-requisites.

CE 549 – Computational Watershed Hydrology

Usually offered	Fall
Description	Use of professional computer programs for the calculation of the runoff from complex basins. Generation of unit hydrographs. Calculation of losses, channel and reservoir routing, parameter optimization, and application of Kinematic wave technique to urban catchments.
Pre/Corequisites	C E 340, 343. Authorized equivalent courses or consent of instructor may be used in satisfying course pre- and co-requisites.

CE 590 – Water Resources Systems Engineering

Usually offered	As needed
Description	Systems analysis, modeling, and optimization in water quantity and water quality management; linear, nonlinear, and dynamic programming models; stochastic models; risk analysis; simulation. Application to engineering problems found in the areas of water supply, water quality and process control, residuals, urban drainage, and river basin development and management.
Pre/Corequisites	C E 393. Authorized equivalent courses or consent of instructor may be used in satisfying course pre- and co-requisites.

CE 597 – Environmental Fluid Mechanics

Usually offered	Offered in alternate years
Description	Advanced fluid mechanics associated with environmental flows, with variable focus. Possible focus includes density-stratified flows (internal waves, plumes, estuarine circulation); rotational flows (geostrophic flows, Kelvin waves, Eckman layers); turbulence and mixing in the environment; dynamics of lakes. Offered in alternate years
Pre/Corequisites	An intermediate course in hydraulics or fluid mechanics. Authorized equivalent courses or consent of instructor may be used in satisfying course pre- and co-requisites.

CE 641 - Statistical Hydrology

Usually offered	Offered in alternate years
Description	Probability distributions applicable to hydrologic events; analysis of extremes, floods and droughts; statistical association between hydrologic variables. Analysis of hydrologic time series. Spectral and parametric formulation of stochastic models of rainfall, runoff, rainfall-runoff transfer, and other hydrologic variables. Application of Markov chains and point processes to the sequence of rainfall and other hydrologic events.
Pre/Corequisites	C E 542, STAT 516. Authorized equivalent courses or consent of instructor may be used in satisfying course pre- and co-requisites.

CE 642 - Advanced Hydrology

Usually offered	Offered in alternate years
Description	Flood routing and overland flow theory. Parametric hydrology, linear and nonlinear analysis of rainfall-runoff systems, unit and instantaneous unit hydrographs. Conceptual and digital models for the simulation of the hydrologic processes in watersheds and for runoff prediction
Pre/Corequisites	C E 542. Authorized equivalent courses or consent of instructor may be used in satisfying course pre- and co-requisites.

CE 644 - Advanced Problems in Hydromechanics and Hydraulic Engineering

Usually offered	Offered in alternate years
Description	Ideal fluid flow theorems and examples, conformal mapping, turbulence, transients, wave theory; transport processes; and other topics selected by the instructor.
Pre/Corequisites	C E 540. Authorized equivalent courses or consent of instructor may be used in satisfying course pre- and co-requisites.

CE 646 - Advanced Subsurface Hydrology

Usually offered	Offered in alternate years
Description	Civil engineering aspects of ground water and contaminant transport. Development and application of the differential equations governing the flow of ground water and contaminants. Diffusion equations for confined and unconfined aquifers. Convection, molecular diffusion, kinematic dispersion, the interactions between the immobile phase and transported substances, linear and nonlinear adsorption, adsorption of organics and heat transfer. Application of regionalized variables theory (Kriging) to subsurface flow and contamination problems.
Pre/Corequisites	C E 542 or 544. Authorized equivalent courses or consent of instructor may be used in satisfying course pre- and co-requisites.

CE697 – Physical Processes in Lakes

Usually offered	As needed
Description	Introduction to water circulation in lakes and the underlying physical processes causing this motion.

Related Coursework in Other Departments

Aeronautics and Astronautics Engineering

A&AE 412 - Introduction To Computational Fluid Dynamics

A&AE 520 - Experimental Aerodynamics

A&AE 626 - Turbulence And Turbulence Modeling

Agronomy

AGRY 399W - Environmental Hydrology

Chemical Engineering

CHE 540 - Transport Phenomena

CHE 577 - Flow Phenomena In Porous Media

CHE 620 - Advanced Transport Phenomena I

CHE 621 - Advanced Transport Phenomena II

Earth and Atmospheric Sciences

EAS 403 - Physical Oceanography

EAS 422 - Atmospheric Dynamics I

EAS 423 - Atmospheric Dynamics II

EAS 509 - Data Analysis Techniques In Earth And Atmospheric Sciences

EAS 525 - Boundary Layer Meteorology

EAS 585 - Hydraulic Analysis Of Ground-Water Systems

EAS 637 - Geofluid Dynamics In Rotating Systems

EAS 639 - Atmospheric Fluid Dynamics

Forestry and Natural Resources

FNR 357 - Fundamental Remote Sensing

FNR 502 - Watershed Hydrology, Ecology, And Management

FNR 540 - Wetlands Ecology

FNR 558 - Digital Remote Sensing And GIS

FNR 658 - Advanced Geographic Information Systems (GIS) Concepts

Mechanical Engineering

M E 509 - Intermediate Fluid Mechanics

M E 579 - Fourier Methods In Digital Signal Processing

M E 608 - Numerical Methods In Heat, Mass, And Momentum Transfer

M E 611 - Principles Of Turbulence

M E 614 - Computational Fluid Dynamics