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**: CE 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**: CE 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**: CE 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,
saltwater intrusion, ground water quality and contamination.

Pre/Corequisites  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
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.

CE 697 – 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
ME 509 - Intermediate Fluid Mechanics
ME 579 - Fourier Methods In Digital Signal Processing
ME 608 - Numerical Methods In Heat, Mass, And Momentum Transfer
ME 611 - Principles Of Turbulence
ME 614 - Computational Fluid Dynamics