

Water Related Courses at MTU

Civil & Environmental Engineering					
Course #	Course Title	Credits	Semester	Faculty	Course Description
CE 3501	Environmental Engineering Fundamentals	3	Fall	M. Auer, Honrath Perlinger Urban	Basic principles and calculations for environmental engineering. Covers application of mass balance, energy balance, and physical/chemical/biological principles to water and wastewater treatment, surface water quality, air quality, solid waste management, and groundwater quality.
CE 3502	Environmental Monitoring & Measurement Analysis	3	Spring	Paterson, Urban	Introduction to environmental data acquisition and interpretation, fundamentals of environmental monitoring, instrumentation, measurement techniques, and statistical analyses. Measurements are conducted in a variety of engineered and natural environments. Probability and statistical analyses are applied to the collected data.
CE 3503	Environmental Engineering	3	Fall, Spring, Summer	M. Auer, Hand Paterson Balliod	Application of fundamental chemical, biological, and physical principles of environmental engineering to design and operation of systems used for water and wastewater treatment, solid waste management, air pollution control, and analysis of quality of surface water, air, and groundwater.
CE 3610	Hydrology	2	Fall, Spring	Barkdoll, Watkins Griffis	Components of the hydrologic cycle and their interactions. Emphasizes rainfall-runoff relationships as applied to civil engineering. Also includes probability concepts, frequency analysis, and hydrologic flood routing.
CE3620	Water Resources Engineering	4	Fall, Spring	Barkdoll, Watkins Griffis	Introduction to hydrologic engineering, including rainfall-runoff modeling and hydrologic frequency analysis. Analysis and design of hydraulic systems such as pipe networks and storm water management systems. Computational, field, and experimental laboratory sessions reinforce lectures and provide hands-on learning opportunities.
CE4501	Environmental Engineering Chemical Processes	4	Fall	Mihelcic, Perlinger, Urban	Application of chemistry, conservation principles, and mathematics to the analysis of chemical processes occurring in natural and engineered environments. Topics include acid-base phenomena, the carbonate system, precipitation/dissolution, redox chemistry, diffusion, mass transfer, and applications to engineering design. Laboratory experiences illustrate principles and modern measurement.

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Course #	Course Title	Credits	Semester	Faculty	Course Description
CE4505	Surface Water Quality Engineering	3	Fall	M. Auer, Urban	Develops the scientific basis for water quality management in lakes and rivers. Considers the origin, behavior, and fate of nutrients and toxic substances. Introduces engineered approaches for lake management, including mass balance modeling. Presents techniques for water quality restoration and the legal framework supporting pollution control.
CE4507	Water Distribution and Wastewater Collection Design	3	Spring	Hand, Baillod, Barkdoll, Hutzler	Application of basic principles in civil and environmental engineering to the analysis and design of water distribution systems, wastewater collection systems, air distribution and collection systems, and their appurtenances.
CE4508	Water and Wastewater Treatment	3	Fall	Baillod, Hand	Principles of physical, chemical and biological processes employed in water and wastewater treatment. Design of selected individual units within water and wastewater treatment systems.
CE4509	Environmental Process Simulation Laboratory	2	Spring	Hand	Provides a rigorous hands-on introduction to laboratory and pilot-plant experimentation and simulation modeling focused on selected physical, chemical and biological water and waste water treatment systems used in environmental engineering.
CE4620	Open Channel Flow	3	Fall	Barkdoll, Watkins, Griffis	Analysis of open channel systems, including natural channels, designed channels, flow transitions, non-uniform flow, and unsteady flow.
CE4630	Hydraulic Structures	3	Spring	Barkdoll, Watkins, Griffis	Analysis and design of water regulating structures. Includes dams, spillways, gates, dikes, levees, stilling basins, culverts, and various minor structures.
CE5502	Biological Treatment Processes	3	Spring	Baillod	Application of kinetics, reactor theory, and microbiology to modeling and design of aerobic and anaerobic wastewater treatment systems. Topics include activated sludge process models and application of these models to process design and operation.
CE5503	Physical/Chemical Treatment Processes	3	Spring	Hand	Advanced theory, fundamentals, and application of physical and chemical processes employed in design and operation of drinking water treatment systems.
CE5504	Surface Water Quality Modeling	3	Spring	M. Auer	Mathematical models are applied in the solution of water quality management problems. The spatial and temporal variation of conservative and reactive substances is simulated in lakes, rivers, and embayments. Kinetic representations of natural phenomena are developed, including mass transport, biogeochemical cycling of nutrients and toxics and food web dynamics.
CE5508	Biogeochemistry	3	Spring/Fall	Urban	Introduction to hydraulics and hydrology. Topics include closed piping systems, pumps, open channel flow, and quantities of water and wastewater.

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Course #	Course Title	Credits	Semester	Faculty	Course Description
CE-CH5509	Transport and Transformation of Organic Pollutants	3	Fall/demand	Perlinger	Assessment of factors controlling environmental fate, distribution, and transformation of organic pollutants. Thermodynamics, equilibrium, and kinetic relationships are used to quantify organic pollutant partitioning and transformations in air, water, and sediments. Use of mass balance equations to quantify pollutant transport.
CE5660	Hydrology II	3	Demand		Advanced hydrology aimed at a more thorough understanding of the individual components of the hydrologic cycle. Includes physical hydrology, hydrometeorology, stochastic hydrology, and remote sensing applications.
CE5664	Water Resources Modeling	3	Fall	Watkins	Application of fundamental principles to develop mathematical models of water resources systems. Includes application of numerical methods, programming to develop simple water resources models, and application of state-of-the-art models for hydrology and river analysis.
CE5665	Sediment Transport	3	Spring	Barkdoll	Basin mechanics of the transport of sediments in natural systems, including tractive forces and geomorphic functions.
CE5666	Water Resources Planning & Management	3	On Demand	Watkins	Economic and environmental aspects of water use. Topics include flood damage reduction, water demand and hydrologic forecasting, water supply planning, and water resource systems operation.
CE5620	Stochastic Hydrology	3	On Demand	Griffis	Application of statistics to problems in surface hydrology. Topics include the flood flow and streamflow frequency analysis, goodness-of-fit tests, model selection, treatment of historical and censored data, regionalization and regression, time series analysis, Bayesian inference, sensitivity and uncertainty analysis methods.

Geological & Mining Engineering & Sciences					
Course Number	Course Title	Credits	Semester	Faculty	Course Description
GE 2500	Introduction to Oceanography	3	Spring	Beske-Diehl	Effect of waves, tides, currents, natural hazards along shorelines, and air-sea interactions on the climate.
GE 3200	Geochemistry	3	Fall	Wood	Introduction to elements of modern geochemistry including aqueous solutions, isotopes, age dating, etc. Emphasizes concepts and quantitative methods. Teaches principles of thermodynamics and phase equilibria from an introductory perspective as they pertain to geologic systems.

Geological & Mining Engineering & Sciences					
Course Number	Course Title	Credits	Semester	Faculty	Course Description
GE 4800	Groundwater Engineering	3	On Demand	Gierke	Application of geohydrology principles to design water-well supplies, site investigations, and subsurface remediation systems.
GE 3850	Geohydrology	3	Fall, Spring	Mayer/Gierke	Geologic and hydrologic factors controlling the occurrence, movement, and development of subsurface water. Quantitative methods for analyzing groundwater systems are introduced. GE3800 or equivalent recommended.
GE 2800	Water and Society	3	Fall	Mayer	The course introduces basic concepts of the water cycle, human interactions in the water cycle, and the social and political dimensions of water. Areas of coverage include: hydrology, water economics, water law, water and politics, water and religion, and water and health.
GE 5810	Flow and Transport in Subsurface Systems	3	On Demand	Gierke/Mayer	Analysis of fluid flow in geologic materials, including groundwater flow, solute and contaminant transport, heat flow, and petroleum movement. Develops fundamental transport equations and numerical methods for solving these equations
GE 5850	Advanced Groundwater Engineering and Remediation	3	On Demand	Gierke	Computer modeling and other advanced topics in the analysis hydrological systems, contaminant transport and fate, and subsurface remediation systems.

Biological Sciences					
Course Number	Course Title	Credits	Semester	Faculty	Course Description
BL3310	Environmental Microbiology	3	Spring	Bagley	General principles of microbiology, focusing on both the use and control of micro-organisms.. Topics include microbial structure, function, growth, metabolism, and diversity, as well as microbial involvement in water and waste treatment, waterborne diseases, and pollution control.
BL 4450	Limnology	4	Fall	Keen	Introductory study of interrelated physical, chemical, and biological processes of freshwater lakes. Field work on local lakes emphasized.
BL 4090	Tropical Island Biology	2	Spring Break	Snyder/Huckins	A survey of island biology, including marine and terrestrial habitats. Topics include formation of carbonate islands, geological history of the Bahamas, island plant communities, intertidal, grass bed, mangrove and coral reef communities. Special course fees.

Biological Sciences					
Course Number	Course Title	Credits	Semester	Faculty	Course Description
BL4451	Aquatic Ecology	4	Fall	Huckins	Integrated coverage of flowing and standing fresh water environments, including physical and chemical factors and their impact on the biota. Applied aspects include biological responses to stress and fisheries management. Emphasizes fieldwork on local environments.
BL4460	Biodiversity & Human Influences on Freshwater Ecosystems	3	Spring Even	N.Auer	Course is designed for upper level undergraduates and graduate students interested in a broader understanding of Biodiversity and life's most precious and necessary resource - freshwater. Class will be a discussion of book chapters, scientific journal articles, contributed case study presentations by students and a semester paper.
BL4440	Fish Biology	4	Spring Odd	Huckins/ N.Auer	Fishes and their habitat, native and exotic fishes of the Great Lakes region, and ocean fishery resources will be examined. Basic topics in Ichthyology and fish ecology, evolution, genetics, reproduction strategies and identification of early life stages, fish community structure, food webs and dynamics. Laboratory exercises on sampling, identification and classification of fishes and basic fish anatomy and discussion of scientific papers relevant to the subject material.
BL 5451	Aquatic Ecology	4	Fall Odd	Huckins	Integrated coverage of flowing and standing fresh water environments, including biological, physical, and chemical factors and their interactions. Applied aspects include biological responses to stress, fisheries, and the management of aquatic systems. Emphasizes the fundamentals of aquatic systems and fieldwork on local environments.
BL 5460	Advanced Ecology: Ecosystems	3	Spring Even	Huckins	Comparison of ecosystem structure and processes with emphasis on lakes. Stresses critical reading of recent journal literature.

University					
Course Number	Course Title	Credits	Semester	Faculty	Course Description

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Course Number	Course Title	Credits	Semester	Faculty	Course Description
UN1001	Freshwater Uses and Abuses	4	Fall	N.Auer	Demands on freshwater supplies worldwide continue to increase as the human population increases. How do we balance the supply with the demand for drinking, irrigation, industry, power and our natural resource management? We will look at countries sharing freshwater supplies, examples of overuse and how we as a nation begin to experience a limit to our "unlimited" supply. How can we better handle this precious resource?

Economics					
Course Number	Course Title	Credits	Semester	Faculty	Course Description
EC 4600	Natural resource and Environmental Economics	3	Spring	Campbell	Examines economic issues related to the supply and use of natural resources and the environment. Resources studied include agriculture, forests, fisheries, nonrenewable resources, water, and wildlife. Topics covered include efficiency, benefit-cost analysis, US environmental policy, and international concerns.
EC5600	Natural Resource and Environmental Economics	3	Spring/ Summer	Campbell	Graduate version of EC4600.

Education					
Course Number	Course Title	Credits	Semester	Faculty	Course Description
ED 3510	Communicating Science I	2	Fall & Spring	J. Schumaker Chadde	Students will learn how to design and deliver hands-on presentations to K-8 students and their parents. Presentations will be delivered at family science nights conducted at area schools. Classroom lectures will highlight the rationale for interacting with schools and communities as a professional, presentation skills, effective teaching techniques, learning styles, classroom management techniques and model hands-on learning techniques

Education					
Course Number	Course Title	Credits	Semester	Faculty	Course Description
ED 3511	Communicating Science II	1	Fall & Spring	J. Schumaker Chadde	Students will make presentations in local K-8 classrooms and/or at evening family science nights conducted at area schools. Classroom lectures will highlight the rationale for interacting with schools and communities as a professional, presentation skills, effective teaching techniques, learning styles, classroom management techniques, and model and-on learning techniques.

Social Sciences					
Course Number	Course Title	Credits	Semester	Faculty	Course Description
SS3240	Landscape Perspectives: History, Anthropology, Geography	3	Fall, Odd years	Scarlett	This course explores how multiple academic disciplines use landscape in order to frame research questions. Topics are drawn from ecological anthropology, environmental and social history, cultural and physical geography, geology, and archaeology. Students begin by establishing common vocabulary of physical geography. They then explore the interplay between environment, cultural practice, and symbolic knowledge through readings and discussions on cartography, evolutionary and cultural ecology, traditional ecological knowledge, and theories of place and space.
SS 3300	Environmental Problems	3	Spring	Henquinet	An examination of local, regional, and global contemporary environmental problems. Critical consideration of underlying social, historical, and economic causes. Case studies drawn from topics such as global warming, ozone depletion, groundwater pollution, solid waste disposal, deforestation, and resource depletion. Studies proposed solutions and their impacts.
SS 3520	U.S. Environmental History	3	Spring	Gorman	Examines how human interaction with physical environment has changed in North America over the last four centuries. Topics include history of US river systems, uses of land by Native Americans, changes associated with European colonization, incorporation of natural resources into industrial economy, early conservation and preservation movements, and environmental concerns accompanying urbanization and industrialization.
SS 3630	Environmental Policy and Politics	3	Fall	Solomon	A broad survey of how environmental policy making actually works in the U.S. Covers both environmental policy processes and politics, and the major environmental policies themselves for control of air pollution, water pollution, hazardous wastes, and other major environmental problems.

Social Sciences					
Course Number	Course Title	Credits	Semester	Faculty	Course Description
SS 5300	Environmental Policy and Politics	3	Fall	MacLennan/ Solomon	An overview of environmental policymaking and politics in the U.S. Emphasizes policies regarding air and water pollution, toxics and hazardous waste. Discussion of rulemaking, enforcement, and administration of laws by EPA. Investigation of environmental politics on national and community levels, with focus on social movements and citizen participation.

School of Forest Resources and Environmental Science					
Course Number	Course Title	Credits	Semester	Faculty	Course Description
FW 3110	Natural Resource Policy	3	Spring	Halvorsen	Covers concepts related to social systems and natural resources. Offers a survey of natural resource (forest, wildlife, water, public lands, and minerals) policies and organizations. State and federal levels of policymaking will be linked to the human values, attitudes, and beliefs that set the context for natural resource policy processes.
FW 4220	Wetlands	4	Fall	Chimner /Gale	Study of the physical, chemical, and biological characteristics of wetlands. Describes functions and values of individual wetland types. Presents management of wetlands and laws governing wetlands. Labs concentrate on field techniques used to assess specific plant, animal, soil, and hydrological characteristics of wetlands.
FW 4370	Forest and Landscape Hydrology (new faculty taking over name and description may change but will be hydrology-focused)	3	Spring	Pypker	Covers the functions of water in the landscape. Emphasizes how forests affect water functions and how water functions change in the landscape due to land use.
FW 5115	Restoration Ecology	3	Spring (alternate years - even years)	Webster/ Chimner/ Huckins	Study the tools, challenges, and philosophical underpinnings associated with ecological restoration. Restoration of forest, grassland, and wetland communities (plant and animal) will be discussed.