

WATER RESOURCES SCI/TECH (WATR)

WATR 1301 Introduction to Water and Wastewater Treatment

Credits: 3 (3-0-0)

This course introduces the basic chemical, biological, and mechanical processes by which conventional water and wastewater treatment plants operate. Students will also be introduced to the legacy and emerging trends in treatment technologies. The course will provide an introduction to water and wastewater regulations, water quality parameters, and conventional water and wastewater treatment unit operations. Students will also gain an understanding of plant design, basic operation, management, and instrumentation at treatment plants. Students will tour actual water plant operations and learn about water purification locally. TSI Restriction(s): Reading, Math, and Writing

Restrictions: Graduate level students may not enroll.

WATR 2350 Topics in Water Resources

Credits: 3 (3-0-0)

Lectures, literature investigation, and discussion in selected topics in water resources science. May be repeated for credit once under a different topic. TSI Restriction(s): Reading, Math, and Writing

Prerequisites: A grade of "C" or better in WATR 1301 and WATR 1302.

Restrictions: Enrollment is limited to Undergraduate level students.

WATR 3312 Water Laws, Rules & Policy

Credits: 3 (3-0-0)

This course provides an introduction of local, state, and federal rules and regulations relevant to water as a resource. Students will examine federal, state, and local approaches to water allocation, pollution control, and resource management on private and public lands. The roles of science, sanctions, economic incentives, opinion, and other influences will be discussed. TSI Restriction(s): Reading, Math, and Writing

Restrictions: Graduate level students may not enroll.

WATR 3315 Inst & Role in Wtr Resrcr Mgmt

Credits: 3 (3-0-0)

In this course students will learn about federal, state, and local institutions and agencies responsible for or advocating management of water resources and the development of the policies, laws and regulations governing water use, distribution, and public health and safety. Each class period students will learn about one or more institutions, with presentations, and detailed review by actual top executive leaders from the institution or agency under discussion. Student projects will involve taking turns researching the presenter's institution and the person's role, and then introducing the presenter to the class. Students will be required to work in groups investigating in detail one institution, a challenging matter currently being addressed by the institution, how the institution has or will solve the challenge, and make a presentation to the class about what they learn. Institutions that students will learn about from the top leadership may include the Texas Water Development Board, San Antonio River Authority, Edward Aquifer Authority, the U.S. Environmental Protection Agency, San Antonio Water Authority, Texas Parks and Wildlife Department, The Nature Conservancy, the Hill Country Alliance, the U.S. Army Corps of Engineers, Underground Water Conservation Districts, U. S. Geological Survey, Texas State Soil and Water Conservation Board, Friends of Blue Hole, and the Natural Resource Conservation Service.

Restrictions: Graduate level students may not enroll.

WATR 3317 Water Sust Use & Conserv Policy

Credits: 3 (3-0-0)

This is a general course investigating water resources science and resource management from the perspective of its value to human society and sustainability. Water has unique properties that make it essential for sustaining all life on Earth, which gives this natural resource a major historic and future role in development of society. The hydrologic cycle is explored as it exists from high above the Earth's surface to miles beneath it. The geology of water's availability to human society is explored, as well as the role of surface water and aquifers in shaping landscapes and human habitation. Students explore the influence of climate on water, distribution and availability of safe drinking water, and pollution of water in the past and current social and economic context of meeting current and future needs of society. Where possible, examples relevant to Texas will be emphasized.

Restrictions: Graduate level students may not enroll.

WATR 3320 Pollutants in Environmental System

Credits: 3 (3-0-0)

This course is the study of the fate of contaminants in natural, disturbed, and man-made water systems. Study will focus on pollutants of concern to public and environmental health, including toxic chemicals, industrial discharges and spills, endocrine disruptor chemicals, methyl mercury, pesticides, sediment-borne contaminants, and other contaminants. Impacts, emergency response, safety advisories, impact on water supplies, and natural remediation processes will be explored, including biodegradation, thermodynamics, aeration, bioaccumulation, state change reactions, acid-base equilibria, speciation, solubility, redox chemistry, dilution, and sequestration. TSI Restriction(s): Reading, Math, and Writing

Restrictions: Graduate level students may not enroll.

WATR 3321 Water Policy Institution Inter**Credits:** 3 (3-0-0)

This internship course will familiarize students with how regulatory agencies function and the day-to-day operations entail, including permitting, inspection, policy revision, stakeholder meetings, administrative procedures. Students will gain the exposure to the type of works and the environments at regulatory institutions relevant to water resources management.

Restrictions: Graduate level students may not enroll.**WATR 3325 Aquatic System Science****Credits:** 3 (3-0-0)

Aquatic science is covered comprehensively, with relevant principles of biology, chemistry, physics, geology, geography, hydrology, and ecology highlighted. Students explore aquatic systems from aquifer/headwaters to ocean with emphasis on Texas ecosystems. Students also are presented an introduction to the laws, policies and environmental perturbations impacting aquatic ecosystems and what citizens and governments are doing to manage these systems. TSI Restriction(s): Reading, Math, and Writing

Restrictions: Graduate level students may not enroll.**WATR 3330 Green Systems for Environmental Remediation****Credits:** 3 (3-0-0)

Students will learn about using constructed green systems to improve the quality of impaired water (such as urban and agricultural runoffs, sewer overflows, and municipal/industrial effluents) and stormwater management. Students will examine best practices in restoration of wetlands, riparian zones, and other natural areas in a watershed that may function in bioremediation of wastes and augment municipal and industrial treatment. Work will include assessing the effectiveness and value of natural ecologic functions in the maintenance of healthy watershed systems and water sustainability. Students will learn from practicing professionals about recent advances in urban and multiple-use planning that incorporate extensive use of greenways and other green infrastructure for the management of water distribution, wastes, and sustainable water systems, as well as support local agriculture and industry. TSI Restriction(s): Reading, Math, and Writing

Restrictions: Graduate level students may not enroll.**WATR 3331 Hydrology****Credits:** 3 (3-0-0)

Students in the course will study the hydrologic cycle and relevant atmospheric processes, water and energy balance, radiation, precipitation formation, infiltration, evaporation, vegetation transpiration, groundwater flow, storm runoff, and flood processes. Students will also study the collection, compilation, and interpretation of data for quantification of the components of the hydrologic cycle, including precipitation, evaporation, infiltration, and runoff. They will use hydrologic variables and parameters for development, construction, and application of analytical models for selected problems in hydrology and water resources.

Restrictions: Graduate level students may not enroll.**WATR 3332 Introduction to Hydraulics****Credits:** 3 (3-0-0)

Fundamentals of hydraulics, its components and related systems. The course will introduce the principles of hydraulics, how the system works, and its applications in water resources management. The course will also introduce components such as motors, pumps, valves, cylinders, and fluids. TSI Restriction(s): Reading, Writing, and Math

Prerequisites: WATR 1301.**Restrictions:** Graduate level students may not enroll.**WATR 3340 Water Resources Science and Technology Internship****Credits:** 3 (3-0-3)

Students taking this course conduct specialized work on an individual basis, that includes training and actual practice working in a water resources science or water technology related for profit business, government agency, municipal agency, or nonprofit organization in the area of industrial water technology or water resource management. Students will be engaged in supervised experiential learning, under the direction of a university faculty member and employees of participating organizations. Students will have the opportunity to be involved in activities such as data collection, analysis, report writing, and plant, field or laboratory experiences. TSI Restriction(s): Reading, Math, and Writing

Prerequisites: WATR 3312; junior standing.**Restrictions:** Enrollment limited to students with a semester level of Junior. Graduate level students may not enroll.**WATR 4081 Research Experience in Water Resources****Credits:** 0 (0-0-0)

This zero-credit directed research course is designed to provide students with an opportunity to conduct faculty-supervised research in an area of mutual interest. The course will provide an opportunity to obtain hands-on research experience and pursue challenging topics without risking grades. Students enrolled in the course will receive lab safety training and other activities to meet research compliance. If approved, the instructor may allow lab access to students engaged in research. TSI Restriction(s): Reading, Writing, and Math

Prerequisites: Instructor's approval.**Restrictions:** Enrollment is limited to students with a major in Water Resources Sci Tech. Graduate level students may not enroll.**WATR 4181 Research****Credit:** 1 (1-0-0)

This course provides an independent research opportunity that will allow undergraduates majoring in Water Resources Science and Technology to make an original intellectual contribution to the subject. The research will be conducted in collaboration with a faculty mentor. Students may repeat the course once as an elective for additional credit. TSI Restriction(s): Reading, Math, and Writing

Prerequisites: a grade of "C" or better in WATR 1301, WATR 1302, CHEM 2371, CHEM 2171.**Restrictions:** Graduate level students may not enroll.**Repeat Status:** Course may be repeated 2 time(s).

WATR 4191 Water Resources Science and Technology Seminar**Credit:** 1 (0-0-1)

Current topics in water resources science and technology are explored by students, along with guest presentations by experts in the field. Students may engage in "Point-Counter Point" debates. Students will research topics before class and participate in discussions. TSI Restriction(s): Reading, Math, and Writing

Prerequisites: Senior standing.**Restrictions:** Enrollment limited to students with a semester level of Senior. Graduate level students may not enroll.**WATR 4305 US-Mex Borderlands Wtr Issues****Credits:** 3 (3-0-0)

Students will study interjurisdictional policy and scientific water management issues in the U.S.-Mexico border region. Water there are shared bi-nationally, with rivers flowing from one county to the other or forming the international boundary. Students will learn about efforts protecting and restoring watersheds and water quality in these rivers. Adequate drinking water and basic sanitation services requires collaborative bi-national, multi-jurisdictional planning efforts. They will examine the significant and complex challenges in shared watersheds that are exacerbated by high population growth rates and impacts from climate change. Students will explore the full range of water-related issues along the border and compare them with interjurisdictional water and transboundary lakes issues elsewhere in the world.

Restrictions: Graduate level students may not enroll.**WATR 4310 Desalination and Emerging Technologies****Credits:** 3 (3-0-0)

This course takes advantage of close proximity to one of the first inland desalination plants that uses saline groundwater for freshwater production. Students will learn about the full range of desalination technologies in use and under development. Instruction will include membrane systems, microfiltration, distillation, atmospheric water generation, reverse osmosis, forward osmosis, brine disposal, electrodialysis, solar desalination, and small-scale desalination solutions. Students will participate in a field trip to a production-scale desalination facility where they will discuss desalination technologies and plant operations with practicing operators and technical experts. Students will also participate in a small-group cooperative research project from which a scientific report will be written. Results of the research will be orally presented to the class as a scientific report/paper. TSI Restriction(s): Reading, Math, and Writing

Prerequisites: CHEM 2371, CHEM 2171, WATR 1301.**Restrictions:** Graduate level students may not enroll.**WATR 4315 Advanced Wastewater Recycling Systems****Credits:** 3 (3-0-0)

This course is about water treatment technologies that are rapidly advancing the state of the art in pollution control. Taking advantage of San Antonio's proximity to oil fields, students will be exposed to innovative technologies coming into use through research and proof of concept testing directed at finding solutions to water resource impacts and usage during energy extraction, especially resulting from hydrologic fracturing processes. They will have an opportunity to explore compact modular treatment works now addressing unique pollution treatment requirements of specific industries and locations where a "one size fits all" approach to treatment of effluents no longer exists. New strategies for advanced recycling of gray water wastes, as well as innovative uses of black water and industrial effluents will be explored. Students will have an opportunity to visit field locations where new oilfield and industrial directed technologies are being used. TSI Restriction(s): Reading, Math, and Writing

Prerequisites: CHEM 2371, CHEM 2171, WATR 1301.**Restrictions:** Graduate level students may not enroll.**WATR 4330 Water Management and Field Investigations****Credits:** 3 (3-0-0)

This course provides an introductory course on the chemical and biological characteristics of groundwater, groundwater assessment and management, aquifer storage technologies, life underground, value to society, and the interactions of surface water and groundwater with the geologic environment. Topics include microbial processes, water quality sampling techniques, capacity, flow rates, living communities, aquifer mapping and modeling, recharge rates and projections, remote sensing techniques, impact of energy production activities, uses, role in society and economic value, and the fate of chemicals, contaminants, and dissolved components in water. Students will have an opportunity to explore groundwater through use of simple demonstration models and field visits to locations where groundwater management activities are currently underway. The course will include field activities, and students will participate in a small-group research project from which a scientific report will be written. Results of the research will be orally presented to the class as a scientific report/paper. TSI Restriction(s): Reading, Math, and Writing

Restrictions: Graduate level students may not enroll.**WATR 4340 Environmental Impact Assessment****Credits:** 3 (3-0-0)

This course provides for study of the theory, science, rules and requirements, and practice of environmental impact assessment on aquatic ecosystems and watershed function. Students will have the opportunity to conduct example environmental impact reviews and ecological assessments of water resources and produce sample environmental impact statements and reports. Practicing professionals in the field of environmental impact review will address the class. TSI Restriction(s): Reading, Math, and Writing

Restrictions: Graduate level students may not enroll.

WATR 4350 Adv Topics in Water Sciences**Credits:** 3 (3-0-0)

Lectures, literature investigation, and design in selected topics of water resources science, technology, and management. May be repeated for credit once under a different topic. TSI Restriction(s): Reading, Math, and Writing

Prerequisites: A grade of C or better in WATR 1301 .**Restrictions:** Graduate level students may not enroll.**Repeat Status:** Course may be repeated 1 time(s).**WATR 4375 Storm Water Management****Credits:** 3 (3-0-0)

This course covers the analysis of the hydrology and water quality of urban storm drainage systems, including their impacts on the receiving water systems. Theories and practices for controlling runoff and water quality are examined to minimize urban development's hydrologic and ecologic impacts. The course introduces the USEPA Stormwater Management Model (SWMM). Topics of this course include urban hydrology and hydraulics, stormwater quality and receiving#water impacts, and design of drainage systems. TSI Restriction(s): Reading, Writing, and Math

Restrictions: Graduate level students may not enroll.