CHEE 514 – Sustainable Water Supplies for Remote Communities

Location and Times: TBD

Instructor and Contact Information

Byron Hempel
ENGR 121
Office Hours: By appointment after class
byronhempel@email.arizona.edu

Description of Course

This capstone course integrates engineering and science disciplines with humanities to fully prepare students for the interdisciplinary collaboration required to tackle the Food, Energy and Water Systems (FEWS) challenges of indigenous communities with skill, respect and fellowship. This 4-credit hour course is designed to combine the aspects of the FEWS in engineering, although the course is open to all graduate students. The course primarily focuses on the "water" aspect of the food, energy and water nexus at the start of the course. The second half of the course will tie in the rest of the FEWS subjects into a design project. The course will be a mixture of lecture and project-based learning. Topics to be covered are: regulatory approaches to water quality, water engineering, water issues specifically in Arizona, and a final design project.

Course Prerequisites or Co-requisites

This graduate level course is the capstone course to the FEWS Minor. One course from each of the following groups needs to be completed to take this course: Systems (BE 579, BE 582, or GEOG 596J), Fundamentals (ECE/OPTI 514A, ECE/MSE/OPTI 534, MSE 530, or MSE 550), and Society (AIS 503, AIS 518, AIS 526A, AIS 531A, AIS 537A, or AIS 541A).

Required Texts or Readings

Olsson, G. (2012). *Water and Energy: Threats and Opportunities*. London, U.K.: IWA Publishing.

Additional supplementary material will be provided throughout the course.

Course Objectives and Expected Learning Outcomes

The objective of the course is to give interdisciplinary graduate students a comprehensive look at how water treatment occurs in the United States and apply that knowledge as a capstone design project. The capstone project will integrate the Food-Energy-Water Nexus. Learning outcomes will consist of being able to 1) identify and apply different laws and regulations associated with water and the Navajo Nation, 2) determine and assess water quality from a potable standpoint, 3) apply different treatment techniques used in urban and rural settings, 4) apply reactor design theory to real-world problems, and 5) synthesize a design project to combat water issues in arid rural settings while maintaining cultural and societal balances.

Course Communications

If you need assistance with the course, have questions, or need to discuss other course topics, email me at byronhempel@email.arizona.edu. Students who e-mail me Monday - Thursday can ordinarily expect a response within 24 hours. Students who e-mail after 6 PM on Friday or over the weekend can ordinarily expect a response by noon on the following Monday.

Group Work

This course is designed to facilitate working with groups. With the enormous variety of backgrounds of the students, it is critical to allow for each student to contribute through their own strengths. As FEWSS students, you all will have to collaborate with many different individuals in the workforce to make a lasting change and have optimal designs. As such, we will

have groups of 3-4 students for each of the sections of the course. We will have a poll for the potential rotation and assignments of the groups.

Scheduled Topics/Activities

Major Topic	Week	Minor Topic	Hwks/Exam	Reading
Regulatory basis of water quality management	1	Laws as drivers, Navajo agencies		TBD
	2	Navajo water resources		TBD
	3	Arsenic, uranium, TDS		TBD
Water qualities and aspects of treatment	4	The nature of water and solutes		TBD
	5	Acid/base chemistry	Hwk 1. Units, BOD, acid/base	TBD
	6	Pathogens and disinfection	Exam no. 1	TBD
Ideal reactor, reaction kinetics	7	Mass balances, reaction order, DEMO		TBD
	8	Ideal reactor models, DEMO		TBD
	9	Applications	Hwk 2. Mass balances—ideal reactors w/ rxns	TBD
Off-grid water purification	10	Conventional water treatment		TBD
	11	RO/NF performance	Hwk. 3. NF performance and power demand	TBD
	12	Linking RO to solar power & agriculture	Exam no. 2	TBD
Design problem	13	Group project		
	14	Group project		
	15	Group project	Presentations	

Group Homework Assignments (30% - 10% each)

There will be three homework assignments in the course. These group assignments will be designed to allow for collaborative efforts on solving real-world problems concerning the topics being covered.

Group Creation of a Module (10%)

Throughout the course, teams will be assigned different components of the course to serve as a deliverable to the Navajo Nation. These modules will be designed to allow for immersion of the content learned and provide a source of outreach to the Indigenous Populations.

Individual/Group Exams (40% - 20% each)

For the first two main sections of the course, there will be an exam to conclude the section. This exam will vary between being on a purely individual basis and having a group portion to it. More information will be provided before the day of the exam.

Final Project (20%)

The final project will be initiated after the first exam but majorly focused on and conducted in the last five weeks of the course. Depending on time obligations and the speed of the course, the final project presentation will be held on the last scheduled day of the course or extend into the University scheduled date for the course's final exam. Each team will be in charge of determining a project to help purify water in a remote location of their choosing.

Grading Scale and Policies

A = 90 – 100%
B = 80 – 89%
C = 70 – 79%
D = 60 – 69%
E = 60% or below

Late, incomplete work, and missed presentations will not be accepted, unless there is documentation of a medical or family emergency. Students are given ample opportunity before assignment due dates for instructor feedback.

Subject to Change Statement

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.

University Help and Policies

Absence and Class Participation Policy

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, http://policy.arizona.edu/human-resources/religious-accommodation-policy.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: https://deanofstudents.arizona.edu/absences

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is required at all lectures and discussion section meetings. Absences may affect a student's final course grade. If you anticipate being absent, are unexpectedly absent, or are unable to participate in class online activities, please contact me as soon as possible. *To request a disability-related accommodation to this attendance policy, please contact the Disability Resource Center at (520) 621-3268 or drc-info@email.arizona.edu.* If you are experiencing unexpected barriers to your success in your courses, the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office is located in the Robert L. Nugent Building, room 100, or call 520-621-7057.

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Students are asked to refrain from disruptive conversations with people sitting around them during lecture. Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.

Some learning styles are best served by using personal electronics, such as laptops and iPads. These devices can be distracting to other learners. Therefore, students who prefer to use electronic devices for note-taking during lecture should do so in a way that does not distract other students.

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students.

Accessibility and Accommodations

At the University of Arizona we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, https://drc.arizona.edu/) to establish reasonable accommodations.

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity.

The University Libraries have some excellent tips for avoiding plagiarism, available at http://new.library.arizona.edu/research/citing/plagiarism.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

UA Nondiscrimination and Anti-harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Confidentiality of Student Records

http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa

Additional Resources for Students

UA Academic policies and procedures are available at http://catalog.arizona.edu/policies

Student Assistance and Advocacy information is available at http://deanofstudents.arizona.edu/student-assistance/students/student-assistance

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete and http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal respectively.

Dispute of Grade Policy: If you feel that a grade was inappropriately given, contact me within a week to sort out the grade. Requests after one week will be considered, but most likely not accepted.

Last Notes Before We Begin

I look forward to having you in the course. This is a learning opportunity not only for you all, but also for me. I find that each student has a unique background and is a resource that everyone can benefit from. This is a collaborative course that will benefit everyone if we all work together to better the world around us. As future engineers, scientists, policy makers, designers, social workers, etc., I hope that each student leaving this course (and minor) has a better understanding of how our world can benefit from the holistic approach this program offers.