North Dakota State University
Department of Civil Engineering

CE 478/678: Water Quality Management (3 credits)
(1.5-Engineering Design Credit)

Date/Time/Place:	Mon., Wed., Fri/8:00 – 8:50 AM/IACC 422 (This course is offered over IVN)
Instructor:	Dr. Achintya N. Bezbaruah, 701-231-7461, a.bezbaruah@ndsu.edu
Office:	CIE 201G
Office Hours:	Mon thro' Thur. 10:00 AM - 12:00 Noon, or by appointment (drop-ins are fine!)
Prerequisites:	CE 370, CE 371, CE 408
Text:	**Surface Water-Quality Modeling**, Steven C. Chapra, WCB/McGraw Hill, Boston, MA, 1997 **+ Handouts**
References:	**Water Quality**, Tchobanoglous and Schroeder, 1985
	Wastewater Engineering: Treatment and Reuse, 4th ed., Metcalf & Eddy, Inc., McGraw Hill, Boston, MA, 2003.
	Water Chemistry, Mark M. Benjamin, McGraw Hill, Boston, MA, 2002.
	Environmental Law Handbook, Sullivan, T.F.P., Government Institute, Inc., Rockville, MD.
	Wetlands, 3rd Ed., William J. Mitsch and James G. Gosselink, John Wiley & Sons, Inc., New York, 2000.
	Journals (Instructor to identify specific research papers; suggestions welcome).
	Internet.

General Description:

This course will provide students with an overview of the analytical methods used in the development of water quality models and application of these models to surface and groundwater systems. The physical, chemical, biological, and hydrological characteristics of surface and groundwater systems will be reviewed. Reaction kinetics and material balances will be applied for modeling contaminant transport in the environment. Specific attention will be given to stream and river systems, lake and reservoir systems, wetlands, and groundwater systems. It will also cover new and developing topics/technologies related to water quality. Students will have opportunities to work on mini projects and present their reports to the class. Inductive teaching techniques will be used.

Objectives: *(ABET A, C, E, G, H, J, K)*

1. To enable students to acquire/develop the ability to apply knowledge of mathematics, science, and engineering. (ABET – A)
2. To enable students to acquire/develop the ability to design a system, component, or process to meet desired needs. (ABET – C)
3. To enable students to acquire/develop the ability to identify, formulate, and solve engineering problems. (ABET – E)
4. To enable students to acquire/develop the ability to communicate effectively. (ABET – G)
5. To enable students to acquire/develop the ability to understand the impact of engineering solutions in global and societal context. (ABET – H)
6. Increase students' knowledge on contemporary issues. (ABET – J)
7. To enable students to acquire/develop the ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. (ABET – K)

Outcomes (Outcomes of this course are tied to the Objectives set above):

By the end of this course, the students will be able to

1. explain the importance of water quality in relation to public health, industrial and agricultural uses, and wild life and environmental protection (ABET J)
2. understand the concepts of chemistry, reaction kinetics, and mass balance related to water quality (ABET A, E, K)
3. appreciate the needs and roles federal and state regulations on water quality (ABET J, H)
4. develop and apply mathematical models for river, lake and ground-water quality analyses (ABET A, K)
5. design environmental systems for water quality management (ABET C)
6. understand the need and techniques of effective communication skills in environmental engineering/management (ABET G)

Weightage for Outcomes:

ABET Outcome	A	B	C	D	E	F	G	H	I	J	K
Weight (%)	10	0	50	0	10	0	10	2.5	0	5	12.5

% Scale: 0% has no weight and 100% has the highest weight.

Grading Policy:

Items	Undergraduate	Graduate
Homework	20%	20%
Tests	25%	20%
Final Exam	25%	20%
Project	20%	15%
Graduate Project	N/A	15%
Class Participation	10%	10%
Total	100%	100%

A	B	C	D	F
90.0 – 100%	80.0 - 89.9%	70.0 - 79.9%	60.0 - 69.9%	0.0 - 59.9%

General Requirement:

Topics to be discussed are indicated on the course outline. The information contained in both the reference book articles and lectures may be used to develop homework or exam questions. *This is an advanced level course taught in an inductive way, and students are expected to do self study, read journal articles and browse the internet extensively.*

Homework:

Homework assignments and due dates will be announced in class. Homework problems will not be accepted for grading after the specified due date. A 48-hour allowance may be given with prior permission from the instructor and with a 50% deduction in grade.

Tests/Exam/Quiz:

Quizzes/Tests/Exams will be given as indicated on the course outline. In addition, unannounced quizzes may be given at the instructor's discretion. In general, quizzes/exams may be open book, closed book, or a combination of open and closed book. Use of internet is also not allowed in a closed book quiz/test/exam. The format of an exam will be announced during the class prior to the exam.

Cell Phone/Pager/MP3/iPOD/Laptop Uses:

Use of Cell Phones, Pagers, MP3 Players, iPods, and any other similar devices are not allowed in the class without the permission of the instructor. Please put your devices in mute/off mode to show respect to others. In case of unavoidable and necessary needs for use of such a device, please inform the instructor beforehand. If you use your laptop to take notes in the class, please discuss with the instructor beforehand. Internet browsing is not allowed in the class unless needed for instruction/learning.

Projects:

A project or projects will be assigned during the semester. Requirements and deadlines for the project(s) will be discussed when assigned.

Graduate Credit:

CE 678 is intended to provide the necessary background in water quality management to graduate students in science and engineering. To receive graduate credits students are required to complete a special project related to water quality modeling (in addition to the one done by all students).

Course Outcome Assessment:

Upon completion of CE 478/678, the students should be able to apply physical, chemical, and biological principles to various water quality analyses, and apply mathematical models to the evaluation of water quality in aquatic systems, including rivers, lakes and reservoirs, and groundwater systems. These abilities will be assessed through homework problems, tests/exams/quizzes, and projects.

Expectations of the Instructor:

This is an elective course and students are in this course because they are really interested in it. Inductive teaching techniques will be used and as such your active participation is a must in this course. We will try to learn in a community environment. It is important that we make an extra effort to be in the class everyday. This being an advanced level course, students are expected to read journal articles and browse the internet extensively.

Students' Expectations/Feedback:

Students are requested to post their feedback/suggestions/criticism on the course during the semester by posting anonymous discussion on the Blackboard. A special forum ("Anonymous Course Feedback") has been opened for this purpose in ***Discussion Board*** on the Blackboard.

Academic Honesty:

All work in this course must be completed in a manner consistent with NDSU University Senate Policy, Section 335: Code of Academic Responsibility and Conduct (available on the web at: http://www.ndsu.nodak.edu/policy/335.htm). Violation of this code will result in a penalty or penalties to be determined by the instructor to fit the gravity of the offense and the circumstances of the particular case.

Special Accommodations:

Students with disabilities please contact the instructor for appropriate accommodations. Other accommodations for Projects/assignments/tests/quizzes/exams will be made as per the relevant university policies.

North Dakota State University: Department of Civil Engineering and Construction

CE 478/678: Water Quality Management **Spring 2008**

COURSE OUTLINE/SCHEDULE

Class	Date	Topic/Topics of Discussion
1	January 9	Introduction
2	January 11	Water Resources, Uses and Quality
3	January 14	Methods of Analyses and Basic Chemical Concepts
4	January 16	**Selection of Design/Research Projects and Discussion**
5	January 18	Characteristics of Water
	January 21	**No Class: Martin Luther King, Jr. Holiday**
6	January 23	Characteristics of Water
7	January 25	Water Quality Standards
8	January 28	Stoichiometry, Reaction Kinetics
9	January 30	Stoichiometry, Reaction Kinetics
10	February 1	Design of water quality experiments
11	February 4	**Test No. 1** (for topics discussed from January 9 till January 30)
12	February 6	Mass Balance
13	February 8	Mass Balance
14	February 11	Group Discussion # 1 (Water Quality Management Policy)
15	February 13	Water Quality Models
16	February 15	Water Quality Models
	February 18	**No Class: Presidents' Day Holiday**
17	February 20	Water Quality Models
18	February 22	Water Quality Models
19	February 25	Water Quality Models
20	February 27	ISO 14000; Water Quality Management through Life-cycle Assessment (LCA)
21	February 29	**Test No. 2** (for topics discussed from February 1 till February 15)
	March 3	**No Class: Spring Break**
	March 5	**No Class: Spring Break**
	March 7	**No Class: Spring Break**
22	March 10	**Mid Term Presentations** (Total 2 hours)
23	March 12	Water Quality Management through LCA (Also see **April 14**)
24	March 14	Environmental Risk Assessment and Management
25	March 17	Environmental Risk Assessment and Management
26	March 19	**Test No. 3** (for topics discussed from February 13 till March 12)
	March 21	**No Class: Recess**
	March 24	**No Class: Recess**
27	March 26	Movement of Contaminants in the Environment
28	March 28	Groundwater Movement and Contamination
29	March 31	Transport of Contaminants in Groundwater
30	April 2	Groundwater and Contaminant Fate and Transport Modeling
31	April 4	Total Maximum Daily Load
32	April 7	Total Maximum Daily Load
33	April 9	Natural systems for water quality management
34	April 11	Watershed Management
35	April 14	**Test No. 4** (for topics discussed from March 14 till April 9)
36	April 16	Group Discussion # 2 (Use of LCA in Water Quality Management)
37	April 18	US Regulations on Water Quality
38	April 21	Water Quality Model Demonstration
39	April 23	Water Quality Model Demonstration
40	April 25	Water Quality Model Demonstration
41	April 28	Trends in water quality management: the global perspective
42	April 30	Trends in water quality management: the global perspective
43	May 2	**Student Project Presentations** (Total 2 hours)
44	May 7	**Final Exam (8:00 a.m. – 10:00 a.m.)** (Comprehensive covering the whole course)

Total Meeting Days: 43 (including tests, group discussions, and presentations but excluding final exam)

ABET

(www.abet.org)

ABET, Inc., is the recognized U.S. accreditor of college and university programs in applied science, computing, engineering, and technology. Accreditation ensures the quality of the postsecondary education students receive.

ABET was established in 1932 and is now a federation of 28 professional and technical societies representing the fields of applied science, computing, engineering, and technology.

Through the hard work and dedication of more than 1,500 volunteers, ABET currently accredits some 2,700 programs at over 550 colleges and universities nationwide.

ABET also provides leadership internationally through agreements such as the Washington Accord, and offers educational credentials evaluation services to those educated abroad through ECEI.

Accreditation Assures Quality

In the United States, accreditation is a non-governmental, peer review process that ensures educational quality. Educational institutions or programs volunteer to periodically undergo this review in order to determine if certain criteria are being met. It is important to understand, however, that **accreditation is not a ranking system**. It is simply assurance that a program or institution meets established quality standards.

There are two types of accreditation: institutional and specialized.

- **Institutional accreditation** evaluates overall institutional quality. One form of institutional accreditation is regional accreditation of colleges and universities.

- **Specialized accreditation** examines specific programs of study, rather than an institution as a whole. This type of accreditation is granted to specific programs at specific levels. Architecture, nursing, law, medicine, and engineering programs are often evaluated through specialized accreditation.

In the United States, ABET, Inc., is responsible for the specialized accreditation of educational programs in applied science, computing, engineering, and technology.

More general information about accreditation is available at www.chea.org.

What Is ABET Accreditation?

ABET accreditation is assurance that a college or university program meets the quality standards established by the profession for which it prepares its students. For example, an accredited engineering program must meet the quality standards set by the engineering profession. An accredited computer science program must meet the quality standards set by the computing profession.

ABET accredits postsecondary degree-granting programs housed within regionally accredited institutions. **ABET accredits programs only, not degrees, departments, colleges, or institutions.**

Who Sets the ABET Quality Standards?

The quality standards programs must meet to be ABET-accredited are set by the ABET professions themselves. This is made possible by the collaborative efforts of many different professional and technical societies. These societies and their members work together through ABET to develop the standards, and they provide the professionals who evaluate the programs to make sure they meet those standards.

Why Is ABET Accreditation Important?

- Accreditation helps students and their parents choose quality college programs.
- Accreditation enables employers to recruit graduates they know are well-prepared.
- Accreditation is used by registration, licensure, and certification boards to screen applicants.
- It is a structured mechanism to assess, evaluate, and improve the quality of one's programs.

The ABET Accreditation Process

Accreditation is a voluntary process on the part of an institution. The first step is that an institution requests an evaluation of its program(s). (Only programs that have produced at least one graduate are eligible for accreditation.) Each program then conducts an internal evaluation and completes a self-study questionnaire. The self-study documents whether students, curriculum, faculty, administration, facilities, and institutional support meet the established criteria.

While the program conducts its self-examination, the appropriate ABET commission (Applied Science, Computing, Engineering, or Technology Commission) forms an evaluation team to visit the campus. A team chair and one or more program evaluators make up the evaluation team. Team members are volunteers from academe, government, and industry, as well as private practice.

During the on-campus visit, the evaluation team reviews course materials, student projects, and sample assignments and interviews students, faculty, and administrators. The team investigates whether the criteria are met and tackles any questions raised by the self-study.
Following its campus visit, the team provides the school with a written report of the evaluation. This allows the program to correct any misrepresentations or errors of fact, as well as address any shortcomings in a timely manner.

At a large annual meeting of all ABET commission members, the final evaluation report is presented by the evaluation team, along with its recommended accreditation action. Based on the findings of the report, the commission members vote on the action, and the school is notified of the decision. The information the school receives identifies strengths, concerns, weaknesses, deficiencies, and recommendations for improvements. Accreditation is granted for a maximum of six years. To renew accreditation, the institution must request another evaluation.

When you choose an accredited program, you are choosing wisely.

Accreditation assures that a program has met quality standards set by the profession.

To employers, graduate schools, and licensure, certification, and registration boards, graduation from an accredited program signifies adequate preparation for entry into the profession. In fact, many of these groups require graduation from an accredited program as a minimum qualification. Here are some examples:

- NICET Technologist Certification requires a bachelor's degree from an ABET-accredited engineering technology program.
- The United States Patent and Trademark Office requires applicants in computing to have graduated from an ABET-accredited computing program before they are eligible to sit for the Examination for Registration to Practice in Patent Cases.
- Many state boards of professional licensure in engineering and surveying require applicants to have graduated from an ABET-accredited program. In states where non-ABET graduates are permitted to be licensed, an additional four to eight years of work experience may be required.
- These certification bodies require additional experience and/or credentials evaluation for applicants who have graduated from non-ABET-accredited programs:
    - American Board of Industrial Hygiene
    - Board of Certified Safety Professionals
    - Construction Manager Certification Institute
    - Council on Certification of Health, Environmental, and Safety Technologists
    - Association for the Advancement of Cost Engineering

Be proud to choose an ABET-accredited program.

Whether you study applied science, computing, engineering, or technology, ABET accreditation is an important indicator of your program’s commitment to quality and may be a key to your professional future.