**Course Description**

This remote (web based) course is offered to students pursuing non-nuclear majors as a part of the Nuclear Power Engineering Technology Certificate program. The course is divided into six sections (modules):

1. Water Chemistry for Nuclear Power Plant,
2. Material Science,
3. Electrical Science,
4. Mechanical Science,
5. Civil Engineering for Nuclear Power Plant Engineers,

**Water Chemistry for Nuclear Power Plants** section of the course introduces students to the basics chemistry terms, units, definitions, limits and basic concepts associated with chemistry control for nuclear power plant systems. Topics discussed in this section include

- Fundamentals of Chemistry,
- Principles of Secondary Water Chemistry Control as applied to PWR
- Chemical and biofouling controls for auxiliary systems (PWR, BWR)
- Principles of reactor coolant system chemistry control for PWR and BWR (control and removal of impurities, radiochemistry).

**Material Science** section of the course explains the terms, definitions, and basic concepts associated with reactor plant materials and recognize conditions detrimental to the plant materials. Topics discussed in this section include classification of crystalline materials, imperfections in materials, material behavior and metallurgical definitions, mechanisms of deformation and fracture, effects of radiation on materials, alloys and their power plant applications, nuclear fuel, stress developed in the reactor vessel wall, erosion/corrosion effects, nondestructive test methods.

**Electrical Science** section of the course starts with a review of basic electrical theory followed by an introduction to basic alternating current (AC) and direct current (DC) theory. Topics covered in this section include AC and DC circuits, motors and generators, batteries, voltage regulators, transformers, electrical distribution systems.

**Mechanical Science** section of the course covers the mechanical engineering principals for all engineers at a nuclear power plant. Topics discussed in this section include statics and dynamics, lubrication, bolting fundamentals, piping, valve fundamentals and components, pumps, turbines, vibration, rotating equipment safety.
Civil Engineering for Nuclear Power Plant Engineers section of the course starts with a review of statics followed by a discussion of structural materials used at nuclear power plants. The section is concluded with an introduction of civil design considerations.

Digital Process Control Systems section of the course covers the following topics: temperature measurement, pressure measurement, level measurement, flow measurement, control systems, and logic diagrams (digital control).

Course Objectives (Student Learning Outcomes)
The specific objectives of this course are the following:

**Water Chemistry**
- To understand the chemical properties of materials and the way these properties can impose limitations on the operation of equipment and systems.
- To understand principles of reactor coolant system chemistry control (PWR and BWR).

**Material Science**
- To become familiar with physical and mechanical properties of materials, types of stresses, and mechanisms of fracture and deformation.
- To become familiar with different alloys and their power plant applications.
- To become familiar with the stresses induced in the reactor vessel due to heatup and cooldown.
- To become familiar with different types of mechanical and chemical corrosion, the consequences of their occurrence in a power plant, and methods available to minimize their occurrence.
- To become familiar with various nondestructive testing methods and their primary applications.

**Electrical Science**
- To understand the basic operation of various types of nuclear facility electrical equipment.
- More detailed:
  - To understand the basic operation of various types of nuclear facility electrical equipment.
  - To be able to analyze various electrical circuits and describe the characteristics of elements placed in a circuit.
  - To understand battery operation and characteristics.
  - To understand principles of operation of AC and DC motors and generators.
  - To understand principles of operation of a typical voltage regulator.
  - To become familiar with operating characteristics and applications of different types of transformers.
  - To become familiar with the basic electrical power distribution system and its components.

**Mechanical Science**
- To understand how lubrication is used in plant equipment.
- To become familiar with the most important aspects of bolting.
- To understand the basic principles of piping system design.
- To introduce students to the world of valves in a power plant (types of valves, basic principles of operation).
- To become familiar with functions of pumps and operating principles of different types of pumps.
- To understand the fundamentals of steam turbines (component parts of a turbine, classification of turbines, basics of turbine operations).
- To introduce students to the terminology used in vibration monitoring. The students will be able to identify machinery vibration conditions that are indicators of machine
degradation or potential failure.

• To become familiar with and be able to identify hazards associated with rotating equipment and equipment with other moving parts.

Civil Engineering

• To expose all engineers to civil engineering topics at nuclear plants and allow an understanding of the extent to which civil concerns could apply to engineering tasks.
• To provide an appreciation of basic concepts, an introduction to applicable major procedures, and an awareness of when to seek a civil engineer's assistance.

Digital Process Control Systems (if time permits)
• To become familiar with temperature measuring devices used at most nuclear power plants.
• To become familiar with the construction and principle of operation of the different pressure sensing and indicating devices used at power plants. To understand the techniques used to read gauges and diagnose problems that may occur with gauges and transmitters.
• To introduce students to the basic operational theory of mechanical and electrical level detectors. To become familiar with the expected response of different detectors during adverse conditions.
• To become familiar with a variety of flow measuring devices and their applications at nuclear power plants.
• To understand the basic operation of various types of nuclear facility instrumentation and control systems.
• To become familiar with the purpose and use of logic diagrams. To understand the difference between analog and digital control systems.

Pre-Requisite(s):
Consult with Dr. Karayaka

Course Textbooks/Lecture Notes:


• Notes: Nuclear Power Plant Fundamentals, lecture notes.
• New course materials will be uploaded to the course WebCT page on a regular basis, each new material upload will be followed up with E-mail notifications sent to the class.
• Students are expected to check the WebCT course page regularly and be up-to-date with the course material, progress and assignments.

Major Course Requirements

Attendance:
This course will be delivered and evaluated as a distance education course. No on campus class meetings will be scheduled. Attendance to all these classes is mandatory. Only University approved excuses will be accepted.
Lectures:
The lectures will consist of interactive power point presentations, videos, handouts, and other educational materials. Students are responsible for the material covered in the course materials. The knowledge will be evaluated via homework assignments, short quizzes and take-home exams.

Grading Policy:
The grades will be determined on the usual scale:

<table>
<thead>
<tr>
<th>Final Course Score</th>
<th>Final Course Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>90% and above</td>
<td>A</td>
</tr>
<tr>
<td>80 - 89.5%</td>
<td>B</td>
</tr>
<tr>
<td>70 - 79.5%</td>
<td>C</td>
</tr>
<tr>
<td>60 - 69.5%</td>
<td>D</td>
</tr>
</tbody>
</table>

Grades will be computed according to the table below.

Home work Assignments: 20%
Mid-term exam #1: 25%
Mid-term exam #2: 25%
Final exam: 30%

Homework Assignments
HW assignments will be assigned every week.
HW assignments will include weekly reading material and exercises
All assignments are due by midnight of the due date!
No late homework will be accepted, except for university excused absences.

HW Preparation:
Each HW solution set:
1. give an assignment number and attach assignment as a cover,
2. provide brief problem statements,
3. be neat and legible and present work logically (step by step) to allow
   Teaching Assistant easy follow-up,
4. if asked for a numerical result, give formula and number with units,
5. It is allowed to type your HW instead of handwriting, if you show all steps
   of your solution
6. Appropriate use of engineering software will be encouraged but will not be
   required to complete course assignments.
7. It is allowed to write your HWs by hands and scan it prior submitting

Submission of the HW solution sets:
All HW assignments need to be submitted electronically by e-mail.
HW solution sets:
Work together is encouraged. The participating classmates must be listed on
the first page. However, the final submitted assignments must be individual
work efforts.

If blatant copying is detected for the first time, the score will be 0 for all involved
Late submission (1 week to explain and ask for a new due date):
If a student cannot submit his work by the due date, he has 1 week after
the due date to explain the reasons for delay and ask for a new due date
without GRADE PENALTY. If the student fails to contact instructor, the delayed work will not be accepted
No late submission of the HWs after 2 weeks of original due date
No assignments will be accepted after the last day of classes!
Re-submission of HW sets:
No resubmission for HW assignments.

Examinations
Two major exams and a final exam will be given during the semester.

Exams must be submitted as defined in their corresponding assignments following the described submission process. All exams and projects will be assigned per student; no group work will be accepted.

A final exam for the class will be scheduled according to the approved University Final Examination Schedule. This exam will be comprehensive and cover all information discussed in lectures. Questions about exam scores must be submitted in writing within one week after the exams have been returned or the scores will be considered correct.

Course Policies

Attendance/tardiness
You must attend all classes. You are responsible for any materials covered or handed out or announcements made in your absence. Records of your attendance will be maintained. Students missing classes without the instructor's permission may be withdrawn from the course. Tardiness without the prior consent of the instructor is not accepted.

Absence from class
Students are responsible for all materials assigned and covered in class. If a student is absent, it is his/her responsibility to get the notes, etc. If there are assignments, it is the student’s responsibility to obtain them. Absence is not an excuse for assignments not turned in as due.

Late work and Make-up Exams
Late assignments are not normally accepted. The student will receive a zero on assignments that are turned in after the due date unless a written permission (by email) is secured (from the instructor) prior to the due date. Permission will be granted only in extreme situations. Assignments may be turned in before the due date (they may be left in my mailbox, sent with a classmate, mailed, etc.). Note that hardware or software failure or machine unavailability does not merit an extension on the assignment. No make-up exams are allowed without prior permission of the instructor (Very difficult to obtain).

Grading Error
All questions concerning a test score or grading of a returned test or assignment must be resolved within one week. It is advisable to keep all of your work until the end of the semester. In case of any recording errors or doubts, you may produce them for correction or verification.

Email Address
You must supply the instructor with a current email address and check your email account daily. You supply your email address by sending an email message by the end of the first week to bora.karayaka@tamucc.edu. In the subject area, type ENTC 4490.003.
Cell Phone/Electronic Device Usage
Any cell phone and electronic device usage during the class times is not allowed.

Academic Integrity/Plagiarism.
University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in F.

Dropping a Class
I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. Please consult with me before you decide to drop to be sure it is the best thing to do. Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Nov 5th, 2010 is the last day to drop a class with an automatic grade of “W” this term.

Safety
The safety of students, faculty, staff and visitors to the ET laboratories is a major issue. You must follow safety procedures and use personal protective equipment as required.

Food and Drinks
Eating/drinking is not permitted in the class.

Classroom/professional and ethical behavior
Students are expected to behave in an ethical and professional manner in all class and lab activities. If you feel uncertain about a particular activity, please speak to me BEFORE problems arise. Ethical behavior is a requirement for passing this course.

ACADEMIC ADVISING
The College of Science and Technology requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. The College's Academic Advising Center is located in Faculty Center (FC 168), and can be reached at 825-6094.

Grade Appeals
As stated in University Rule 13.02.99.C2, Student Grade Appeals, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Rule 13.02.99.C2, Student Grade Appeals, and University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules Web site at
For assistance and/or guidance in the grade appeal process, students may contact the Office of Student Affairs.

**Disabilities Accommodations**
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call or visit Disability Services at (361) 825-5816 in Driftwood 101.

If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.