Introduction to Nuclear Engineering

CE497-1 CE Project (Undergraduate Students)
ENGR597-21 Special Projects (Graduate Students)
Fall 2009, MW 4pm-5:15pm, Anderson Auditorium 21
University of Mississippi

Textbook: Dr. Ervin has diligently compiled a Course Handbook consisting of PowerPoint slide handouts.

Course Instructor: Dr. Elizabeth K. Ervin, 208 Carrier; E-mail: eke@olemiss.edu, Phone: (662) 915-5618

Office Hours: 8-10 AM MWF. Undergraduate and graduate student assistance may differ in nature. In any case, please carefully prepare your questions beforehand and answer as many of them as possible for yourself. If the posted hours conflict with your schedule, you can make an appointment in advance, and alternate arrangements will be made to accommodate you. Email is always the best option.
DON'T WAIT UNTIL THE LAST MINUTE TO ASK FOR PROJECT HELP!

Description:
Introduction to power generation field, specifically in the nuclear industry. Multidisciplinary approach to the interrelationships of components, structures, and systems. Topics include history, fission, design principles, reactor systems, health physics, risk assessment, and sustainability.
Credit Hours: 3
Prerequisites: None – Junior/Senior Standing preferred.
Co-requisites: None
Additional Prerequisite/Co-requisite Requirements: Or Graduate Standing

OPEN TO ALL MAJORS with consent of instructor. If you are not registered in the School of Engineering OR if you are a sophomore or freshman, please contact the instructor ASAP.

Objectives:
All Students:
- To understand the fundamental issues in the nuclear industry
- To promote interdisciplinary teamwork in addressing difficult problems
- To employ advanced energy concepts through a course project
- To improve oral and written communication skills

Additional for Graduate Students:
- To contribute original energy-related research through a course project
- To improve technical presentation skills

Grading: Individual Project Based

The standard 10-point scale will be used, but NO traditional homework or exams are required. Weekly journals are required to ensure progress toward project goals but also to continuously improve the course itself.

Attendance and Participation	15%	(sign-in sheets, discussion, behavior, peer review)
Weekly Journals	35%	(Summary/assignment, progress: Due on **Mondays,** 1-2 pgs, 1.5 line spacing, 12-pt Arial, 1-in margins)
Written Project Report	30%	(due after Midterms, >1 week before oral due date)
Oral Project Report	20%	(due the last few weeks of class in **movie** form)

Attendance Policy: **NO** unexcused absences are allowed during the semester - **1%** will be deducted from your final grade. Exceptions will be made based upon prior notification of school-sponsored activity, submission of a doctor's note, or instructor's discretion.

The report is required to test your technical written communication skills, and the oral portion is required to test your verbal communication skills. Along with a grade, an evaluation form will be returned to each student. Technically-based original opinions are also recommended. As an assignment, you will peer review other students papers.

The final oral report will be a 5-minute movie presented at the in-class Colonel's Film Festival. Note that you MUST ensure legality through credits and music: the works will be published to the internet!

Graduate students are required to additionally present their original thoughts and contributions on their project as well. In-class oral presentations are required rather than a film, and questions will be asked.

On-line Resources:
The course website is http://home.olemiss.edu/~eke/nuclear.html and can be linked through Dr. Ervin's personal homepage. Note that any copyrighted information cannot be posted on the web. Papers and presentations may be published on Dr. Ervin's Nuclear Engineering website in order to educate others. If you do not wish your work to be posted, please let Dr. Ervin know.

BlackBoard Resources:
BlackBoard will be used to store grades and post supplementary documents (more often than the website). Communication tool (email and discussion board) use is encouraged.

Accommodations for Students with Disabilities (ADA):
Accommodations will be made for these students after visiting the Office of Student Disabilities Services and submitting proper paperwork.

School of Engineering Honor Code:

All work abides by the School of Engineering Honor Code. Please be sure you understand the provisions of the Honor Code. Unless otherwise stated, all work is to be completed on an *individual* basis. Sharing of segments of reports is not allowed without obtaining prior written approval of your instructor and giving credit to the appropriate source. Oral group discussions are permitted in the hope that such interaction will lead to a better understanding of the material, but preparation of reports/assignments is the responsibility of each individual. Note that each student must submit his or her own written assignments. Excessively identical assignments as determined by the instructor will be given one warning, and then the copiers will be subject to action. **Plagiarism** and cheating will not be tolerated (when in doubt ASK!). In accordance with the Code of Student Conduct, all matters concerning academic dishonesty or computer abuse may be turned over to the Dean of Students Office.

Student Conduct:

Professional behavior is expected. There will be grade penalties for inappropriate behavior.

1. NO student conversations are permitted during lecture. Discussion time will be designated by Dr. Ervin.
2. Students MUST be on time. Tardies and leaving the room disturb everyone. Excessive tardies will count as an absence.
3. Attention and alertness are required. I know that this may be difficult at times, but you must make the most of this educational opportunity.
4. Food, drink, and use of tobacco are prohibited. Okay, no noisy food and clean up after yourself. No pigs allowed.
5. While technology can be extremely beneficial to the learning process, it can also be detrimental. Any sources of class disturbance (including, but not limited to, laptop computers and cellular phones) may be confiscated until the following class meeting. Only one warning will be given. NO TEXTING AT ANY TIME.

Regrade Policy:

All questions regarding the grading of any assignment/exam will only be accepted within the first week after grading is completed, announced in class and the assignment is made available. To submit a regrade request, print/type your name on a separate sheet of paper and include a concise explanation of all your concerns/questions and JUSTIFY why you think you deserve additional credit. *Staple* this sheet to the front of your graded assignment/exam and resubmit it to your instructor during office hours. The assignment will be regraded in its entirety and returned to you. If you continue to have concerns, arrange for an appointment with your instructor to discuss the issue.

Course Evaluation:

As this class progresses, you are encouraged to present your constructive suggestions, compliments, and/or concerns to the instructor. You are also encouraged to bring in any reports, general literature or other information which you come across outside of class that may add to or improve the content or delivery of the course. Such contributions are welcomed and appreciated by your instructor as are constructive comments about the course materials and the course itself.

I am starting a new educational effort this semester and request your input, which is vital to aid me in future courses and even publications. So, please seriously complete all surveys and evaluations. If you have any sensitive issues, feel free to write them in the weekly journal so that I can comment privately.

ASSIGNMENTS

Weekly Journal Format: DUE EVERY MONDAY

Name, Due Date
Summary of What I Learned in Class
Specific Progress on my Project

- Paragraph form
- Typed 1-2 pages, 1.5 line spacing, 12-pt Arial, 1-in margins
- Approximately 500 well-thought-out words

Submit printed copy to Dr. Ervin in-class every Monday. An electronic copy may be requested at a later date, especially to check the word count (hehe).

(For an excused absence, the write-up is still due but by email to eke@olemiss.edu.)

Grading:
Journals will be graded on a 100 point scale as follows:

On-time Submission: 5 points
Grammar: 25 points (spelling, clarity, improvement over the semester)
Class Summary and Comments: 10 points (what did/didn't you learn)
Project Description: 60 points (critical thinking, progress, comprehension, enthusiasm)

Thus, put most effort into carefully writing up the project progress completely.

Technical Written Report

Cover Page

- Title of Project
- Name(s)
- Course Number
- Due Date

Suggested report sections – will vary with individual topic

- Statement of Project Objectives
- Strategy Statement/Literature Review/Project Approach
- Technical Information/Explanation
- Discussion
- Conclusions and Significance

Estimated text length of 8 pages *without bells and whistles*. The true length should be what you need to cover the topic COMPREHENSIVELY, but I know a minimum length must be set.

Technically-based original opinions are also recommended.

Extra Credit for clear and precise reports with excellent discussion. If you need a great deal of help, a writing center is available in the Library.

Grading scale will be announced later but will be objective and comparative. Clarity, neatness, spelling, grammar, and on-time-ness will all count. Grading will be based upon Bloom's taxonomy – your grade will be dependent upon your comprehension, synthesis, and communication of the material.

Along with a grade, an evaluation form will be returned to each student. As an assignment, you will peer review other students papers. Thus, teamwork on this paper is not allowed.

Graduate Students: Greater technical depth is expected of you. You will be additionally evaluated on your original contributions to the project topic.
Examples of originality: higher level understanding such as connections between seemingly unconnected fields; novel ideas on a problem; genuinely new technical work that is publishable.

Oral Report – Undergraduate Students

Fun!

What?

The final oral report will be a movie presented at the in-class Colonel's Film Festival.

A minimum of a 5-minute movie is to be designed and filmed by each student on their project topic of their choice. Be careful to cover the topic fully in five minutes – a longer documentary is recommended. (Titles and credits do not count as part of the five minutes.)

The goal is to teach the project's subject to others – both in-class and on the web.

Grading scale will be announced later but will be objective and comparative. The movies are viewed and rated by all for content, clarity, creativity, and presentation.

For either Mac or Windows, there is no software to buy, but production does matter.

Dr. Ervin is the executive producer and the censor but can help in any other roles that you may need. She also has a video camera and projector available for check-out, but a deposit may be required ;)

Using whatever format you like, the student must be the star. Teamwork is acceptable, but each project/enrollee must have his/her own movie.

For general examples from Tennessee Tech, see Youtube and search CEE1020. Note that you MUST ensure legality through credits and music: the works will be published to the internet!

Oral Report – Graduate Students

Present findings to class in 15-20 minutes using PowerPoint – the goals:

- To educate your classmates on your topic
- To practice presentations and oral communication
- To better understand and answer questions

No formal format, except technical presentation.

You must specifically present your original thoughts and contributions on the project.

Instructor evaluations will be similar to those in ENGR695 seminar course and based upon Bloom's taxonomy.

You will be peer reviewed as well.

Extra Credit is available for making a movie as well. Grad students are allowed to have a little fun, too,

Specific Course Topics*:

I. History of nuclear industry (estimated 1 week)
   a. Development of nuclear energy
   b. Statistically positive safety record
   c. Instructive case studies

II. Fission processes (estimated 1 week)
   a. Preliminary chemistry
   b. Fission processes

III. Design principles (estimated 3 weeks)
   a. Utility operational design
   b. Thermodynamic cycles
   c. Power system components
   d. Importance of valves
   e. Containment design

IV. Reactor systems (estimated 3 weeks)
   a. Plant systems
   b. Pressurized water reactors
   c. Boiling water reactors
   d. Near future commercial designs
   e. Farther future designs

V. Concluding remarks (estimated 2-3 weeks)
   a. Health physics
   b. Applications
   c. Risk assessment
   d. Sustainability
   e. Opportunities in the nuclear industry

VI. New challenges via projects (estimated 2-3 weeks)

Sponsored by the U.S. Nuclear Regulatory Commission and with the help of Entergy and Southern Nuclear Operating Company.

*If there are any additional topics of interest, please let me know. I will be happy to work them in or add even them to the list of project ideas.

Project Topics

Numerous issues involving the nuclear industry and/or power generation are well-suited for technical student projects.

Pick a topic of your interest relating to your background. ANY topic is fair game – just approved first by Dr. Ervin through journal entry. The project can be experimental, analytical, theoretical, review…

The objective is to relate the course subjects to your interests while improving your communication skills.

Sample topics include the following:

- Electromagnetic Interference on Instrumentation*
- Digital System Controls: Validation and Verification*
- Health Physics as a Branch of Chemical Engineering*
- Non-Destructive Testing: Flaw Detection Using Iridium and Selenium
- Electronics Using Radioactive Materials as Semiconductors
- Biomedical Radiation: Diagnostic Imaging and Cancer Therapy
- Nuclear Propulsion of Naval Vessels
- The Use of Nuclear Distillation for Desalination
- Space Power: Rocket Propulsion and Cosmic Radiation
- Global Warming: How the Nuclear Industry Can Change Greenhouse Gas Emissions
- The Mining and Enriching of Uranium
- Gamma Radiation Sterilization as Insect Control
- Food Preservation through Irradiation
- Using the Nuclear Earth as a Geothermal Energy Source
- Nuclear Fusion Concepts (sun, supernovae, dark matter, etc.)
- Yucca Mountain: Storage Technology, Strategy, and Difficulties
- The Use of Robotics in Automated Waste Storage Facilities
- NIMBY: Not In My BackYard!
- Bioremediation through Flora and Fauna

*As suggested by SNOC