

ENU 4191 Elements of Nuclear Engineering Design (1cr), Fall 2013

1. **Catalog Description:** First of a two-course capstone design sequence. This course provides preparatory work for the follow-on ENU 4192 (3 cr) “Nuclear and Radiological Engineering Design.” Accumulation of reference materials and computer codes and development of skills and knowledge needed for successful performance in ENU 4192.
2. **Co-requisites:** ENU4612, ENU4630, ENU4103, ENU4134. (ENU4104 strongly encouraged.)
3. **Course Objectives:** The course emphasizes engineering design, group collaboration, leadership and professional and technical qualities that are needed to succeed in the demanding nuclear engineering environment. Performing in a collaborative team environment, meeting deadlines, preparing high quality reports, making effective presentations and evaluation and feedback are strongly emphasized.
4. **Contribution of Course to Meeting the Professional Component for ABET:**
 - a. Graduates will have successful careers in Nuclear Engineering and related disciplines.
 - b. Graduates will pursue advanced degrees or continuing education.
5. **Program Outcomes Supported by Course:**
 - Outcome a: An ability to apply knowledge of mathematics, science, and engineering for problem solving in engineering.
 - Outcome c: An ability to develop an engineering design to meet specific technical requirements within realistic constraints such as economic, environmental, health and safety and reliability.
 - Outcome d: An ability to function on multi-disciplinary skills teams.
 - Outcome e: An ability to identify, formulate, and solve engineering problems.
 - Outcome f: An understanding of professional, ethical and regulatory responsibility in engineering practice.
 - Outcome g: An ability to communicate effectively, using both oral and written presentations, in engineering practice.
 - Outcome h: The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.
 - Outcome i: A recognition of the need for life-long learning and the ability to adapt this to engineering practice.
 - Outcome j: A knowledge of contemporary issues as they relate to professional engineering practice.
 - Outcome k: An ability to use the techniques, skills, and modern engineering tools, including modern computational skills and tools, necessary for nuclear and radiological engineering practice.
 - Outcome l: An ability to apply advanced mathematics, science, atomic and nuclear physics and engineering to nuclear and radiological systems and processes.
 - Outcome n: An ability to work professionally in one or more areas of: nuclear power reactors, nuclear instrumentation and measurement, radiation protection and shielding, and radiation sources and applications.
6. **Instructor:** Edward Dugan, Ph.D.;
164 Rhines; 273-2129; edugan@mse.ufl.edu
Office Hours T & Th 7th and 8th periods; Wed 2nd and 3rd periods; or by appointment
7. **Teaching Assistant:** none

8. Lecture Meeting Time: MWF 9th (4:05-4:55)

9. Laboratory Meeting Time: N/A

10. Meeting Location: 227 NSC

11. Material and Supply Fees: N/A

12. Textbooks: Handouts, Computer Code Packages from RSICC and Instructor's Notes

13. Recommended Reading/References:

Fundamental of Engineering (FE) Supplied Reference Handbook:

http://www.ncees.org/exams/study_materials/fe_handbook/index.php

1. *Handbook of Nuclear Reactors Calculations*, Vol. I, Ed. Y. Ronen, CRC Press, 1986.
2. *A Guide to Nuclear Power Technology*, F.J. Rahn, et al., J. Wiley & Sons, 1984.
3. *Structural Materials in Nuclear Power Systems*, J.T.A. Roberts, Plenum Press, 1981.
4. *Principles of Design Improvement for Light Water Reactors*, L.S. Tong, Hemisphere Publishing, 1988.
5. *Thermal Design of Nuclear Reactors*, R.H.S. Winterton, Pergamon Press, 1981.
6. *Nuclear Power Plant Design Analysis*, Alexander Sesonske, NTIS TID 26241, 1973.
7. *Nuclear Reactor Analysis*, J.J. Duderstadt & L.J. Hamilton, J. Wiley & Sons, 1976.
8. *Nuclear Systems I & II*, N.E. Todreas & M.S. Kazimi, HPC, 1990.
9. *Heat Transfer and Fluid Flow in Nuclear Systems*, Henri Fenech, Pergamon Press Inc, 1981, ISBN 0-08-027 181-2.
[Chapter 2 is for pressurized subcooled water systems, Chap 3 is for boiling water systems, Chap 4 is for liquid metal cooled systems, Chap 5 is for helium cooled systems and Chap 6 is for heat exchangers/steam generators.]
10. *Nuclear Power Plant Engineering*, James H. Rust, Haralson Publishing Company, 1979, ISBN 0-934534-00-4. [A little bit of everything on design, except economics, in abbreviated form.]
11. *Nuclear Heat Transport*, M.M. El-Wakil, International Textbook Company (and ANS), 1971, ISBN 0-7002-2309-6.
12. Nuclear Power Plant's FSARs
13. *Nuclear Fuel Cycle: Analysis and Management*, Robert Cochran and N. Tsoulfanadis, 1993.
14. *Nuclear Power Reactor Instrumentation Systems Handbook*, Vol. I & II, J. M. Harrer and G.Beckerely, USAEC, 1973.
15. PE Review Manual
16. *Radiation Detection and Measurement*, 2nd Edition, G. F. Knoll, 1979.
17. *Radiation Shielding*, J. K. Shultis and R. E. Faw, 2000.
18. *Fundamentals of Nuclear Reactor Physics*, E.E. Lewis, Academic Press, Elsevier Inc, 2008, ISBN 978-0-12-370631-7.
19. *Nuclear Reactor Physics*, Weston M. Stacey, 2nd Edition, John Wiley & Sons, 2007.
20. *Introduction to Nuclear Engineering*, J. Lamarsh and T. Baretta, 3rd Edition, Prentice Hall, 2001.

14. Course Outline:

Date	Topic
Aug 21 (W) Aug 23 (F)	Introduction: course expectations and goals. Order required literature and computer codes
	FE Reference Handbook from NCEES
	(1) SCALE6.1/ORIGEN and (2) MCNP6_BETA3/ MCNP5/MCNPX code packages from RSICC
Aug 26 (M) Aug 28 (W) Aug 30 (F)	Preparation of papers, reports and presentations. Overview of expectations of teams/groups. Reports, references and peer evaluations.
Sept 2 (M)	Holiday - Labor Day
Sept 4 (W) Sept 6 (F) Sept 9 (M)	Engineering Economy Engineering Economy Economy HW problem(s) (I)
Sept 11 (W) Sept 13 (F) Sept 16 (M)	MCNP Introduction and Overview MCNP Introduction and Overview MCNP Introduction and Overview
Sept 18 (W) Sept 20 (F)	Selection of Design Teams/Groups Description of Selected Design Project(s)
Sept 23 (M) Sept 25 (W) Sept 27 (F)	***No classes this week*** Design teams gather information for draft design proposal (G).
Sept 30 (M) Oct 2 (W) Oct 4 (F)	SCALE Overview SCALE Criticality Problem(s) Further work with SCALE as needed
Oct 7 (M) Oct 9 (W) Oct 11 (F)	MCNP k-code calculations. Criticality HW problem(s) (I)
Oct 14(M) Oct 16(W) Oct 18 (F)	Draft group project proposals (G) due Monday. Shielding analysis using MCNP and/or SCALE and/or Microshield reviewed this week

Oct 21 (M) Oct 23 (W) Oct 25 (F)	Burnup/Depletion calculation overview. CASMO4 and/or MCNP and/or ORIGEN discussed this week
	Comment: may or may not be necessary to look at NEWT/TRIDENT depending on selected project
Oct 28 (M) Oct 30 (W) Nov 1 (F)	No classes scheduled this week Teams work on design project
Nov 4 (M) Nov 6 (W) Nov 8 (F)	No formal classes; meet with design teams as needed to answer questions No Class - Homecoming
Nov 11 (M) Nov 13 (W) Nov 15 (F)	No class: Veterans Day and ANS Meeting in D.C. No class: ANS Meeting in Washington, D.C. No class - teams work on design project
Nov 18 (M) Nov 20 (W) Nov 22 (F)	Instrumentation & Control Instrumentation & Control Meet with design groups to review progress
Nov 25 (M)	Meet with design groups to review progress
Nov 27 (W) to Dec 1	Thanksgiving Holiday
Dec 2 (M) Dec 4 (W)	Design Group Presentations (G) Design Group Presentations (G)
Dec 11 (W)	Final Submission of Written Design Report (G)

I - Individual Assig
G – Group Assignment

15. Attendance and Expectations: Attendance is required; students should inform the instructor if they cannot attend a class (**See Item 18**).

Class distractions such as **cell phones and pagers are unacceptable**. Students will ensure that any such devices that are brought into the classroom will be turned off or operated in a silent mode during the class period

16. Grading: Grades are based on performance achieved in the following:

Individual Assignments: 80 %

Group Project (Report and Oral Presentation): 20 %

17. Grading Scale: A (91-100%), B(81-90%), C(71-80%), D(60-70%), E(<60%)

Note: *minimum grade of C is required in this course in order to receive B.S.N.E. degree.*

18. Make-Up Policy: Attendance is mandatory and assignment due dates must be adhered to except for valid, documented medical reasons or unless prior arrangements have been made with the instructor(s).

19. Honesty Policy:

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Note that failure to comply with this commitment will result in disciplinary action compliant with the UF Student Honor Code Procedures.

See <http://www.dso.ufl.edu/sccr/procedures/honorcode.php>

20. Students with Disabilities

Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

21. UF Counseling Services – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

- UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, <http://www.counseling.ufl.edu/cwc/Default.aspx>, counseling services and mental health services.
- Career Resource Center, Reitz Union, 392-1601, career and job search services.
- University Police Department 392-1111.

22. Software Use

All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

23. Students are expected to provide feedback on the quality of instruction in this course based on 10 criteria.

These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.