

ENU4191 Elements of Nuclear Engineering Design (1 cr), Required Course, Fall 2014

1. Catalog Description: (1 cr) First of a two-course capstone design sequence. This course provides preparatory work for the follow-on ENU4192 (3 cr) “Nuclear and Radiological Engineering Design.” Tasks include accumulation of reference materials and computer codes and development of skills and knowledge needed for successful performance in ENU4192.

2. Co-requisites: ENU4612, ENU4630 and ENU4134 (ENU4104 is strongly encouraged).

Pre-requisites: ENU4144 and ENU4103

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:

1. Graduates will have successful careers in Nuclear Engineering and related disciplines.
2. 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.; Room 235 NSC, edugan@mse.ufl.edu Phone: 846-1376

Office Hours: Generally, I should be available MWThF from 9:30AM to 12:30PM and WTh from 3PM to 5PM. If you email me questions, I will try to respond as soon as possible.

7. Teaching Assistant: none

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

Final Exam: Tue, Dec 16, 7:30AM – 9:30AM (Exam Group 16A) – N/A

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

Code Packages Needed: MCNP6/MCNP5/MCNPX and SCALE6.1 (Procured from RSICC)

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 (tentative):

- a. Course expectations and goals
 - Preparation of papers, reports and presentations
 - Overview of expectations of teams/groups
 - Reports, references and peer evaluations
- b. Engineering Economy
- c. Instrumentation & Control
- d. Reactor Operations
- e. Mechanics of Materials
- f. MCNP Overview
- g. Selection of Design Teams
 - Selection of Design Project(s)
- h. SCALE Overview
- i. SCALE/KENO Criticality or k-code Calculations
 - and comparison with MCNP results from ENU4104
- j. Presentation of Draft Group Project Proposals
- k. Shielding Calculations using MCNP and/or SCALE
- l. Burnup/Depletion Calculations using MCNP, ORIGEN or CASMO
- m. Work on Design Projects
- n. Review of Group Project Progress
- o. Design Project Presentations

Note: Order of presentation of topics subject to change.

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

16. Grading: Grades are based on performance based on the following:
Individual Assignments: 75 %
Group Project (Report and Oral Presentation): 25 %

- 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 continue on with ENU4192; minimum grade of C is required in ENU4192 to receive a 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:** All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.
- 20. Accommodation for Students with Disabilities:** Students requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting the 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:
- University Counseling Center ,301 Peabody Hall, 392-1575, Personal and career counseling.
 - SHCC mental Health, Student Health Care Center, 392-1171, personal counseling
 - Center for Sexual Assault/Abuse Recovery and Education (CARE,) Student Health Care Center, 392-1161, sexual assault counseling
 - Career Resource Center<Reitz Union, 392-1601, career development assistance and counseling
- 22. Software Use:** All faculty, staff and students of the University of Florida 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.