

Elements of Nuclear and Radiological Engineering Design

ENU 4191 Section 6299

Class Periods: M 1605-1800 (UF "Periods" 9-10) and F 1605-1655 (UF "Period" 9)

Location: Turlington Hall 2349

Academic Term: Fall 2025

Changes to this syllabus will be provided via the Canvas platform. Such changes may include those required by policy changes, changes in the speed of course coverage, university closure, errors in previous syllabus versions, and other reasons.

Instructor:

DuWayne Schubring, Ph.D., Instructional Professor

317A Materials Engineering Building (MAE, not MAE-A, MAE-B, or MAE-C)

352-294-7870

dlschubring@ufl.edu (This is the best way to reach me. The Canvas "Inbox" feature is not real e-mail. Messages sent via that system will not be acknowledged.)

No TA

Office Hours: M 1245-1345; T 1315-1415; WRF 1255-1415

Office hours are held in a hybrid format, with online availability via the following Zoom link:

<https://ufl.zoom.us/j/9057355922>

For Zoom attendees: if you are in a private space (e.g.; your own house or apartment, a dorm room, etc.), please turn your camera off. If you are in a public space (e.g.; unused classroom, outdoors at UF), your camera status is at your discretion.

At the beginning of an office hour block, all those in line in person at the start of the office hour block will be addressed first, followed by those on Zoom who have been there since the start of the office hour block. If there is a line, visits are limited to 10 minutes per student or group. If you have further questions, you may go to the back of line and potentially return. Once both lines are cleared, I will continue on a first-come, first-served basis with no preference for in-person vs. Zoom.

End times of office hours will be enforced strictly, even if students are still waiting, as I have other engagements (including teaching class) immediately after each office hour block.

There are no office hours on days when no UF classes are held, including reading days and finals week.

Course Description

The first of a two-course capstone design sequence. A one-hour lecture that provides preparatory work for ENU 4192. Identification of initial design project(s) and areas of work, selection/assignment of groups to areas of work/tasks, accumulation of reference materials and computer codes and development of initial timelines/milestones. (1 credit)

Course Pre-Requisites

ENU 4103 and ENU 4133

Course Objectives

This Senior Capstone course sequence will train students in a large team-based project, including multiple technical areas within the NE undergraduate program. Written and oral communication will be emphasized.

ENU 4192 will involve design of a nuclear fission reactor, to be completed in groups. The purpose of ENU 4191 is to prepare you for ENU 4192. This includes the following broad foci for ENU 4191:

- Development of engineering design skills, including work in teams
- Development of familiarity with nuclear engineering codes, with a focus on code selection (training in operation of the codes is generally not part of ENU 4191, though tutorials on MCNP criticality may be offered to the class) and, if needed, acquisition of legal copies of the codes
- Reinforcement and backfilling of selected technical content (such as engineering economy and communication skills) that does not fit comfortably within other required courses
- Exploration of the full range of reactor technology options, including non-LWR choices

No Materials and Supply Fees

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	None
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	High
3. An ability to communicate effectively with a range of audiences	High
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	Low
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative environment, establish goals, plan tasks, and meet objectives	Medium
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	None
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	High

No Required Textbooks or Software

Recommended Materials (references)

Useful references for ENU 419x include, but are not limited to:

- Handbook of Nuclear Reactors Calculations, Vol. I, Ed. Y. Ronen, CRC Press, 1986.
- A Guide to Nuclear Power Technology, F.J. Rahn, et al., J. Wiley & Sons, 1984.
- Structural Materials in Nuclear Power Systems, J.T.A. Roberts, Plenum Press, 1981.
- Principles of Design Improvement for Light Water Reactors, L.S. Tong, Hemisphere Publishing, 1988.
- Thermal Design of Nuclear Reactors, R.H.S. Winterton, Pergamon Press, 1981.
- Nuclear Power Plant Design Analysis, Alexander Sesonske, NTIS TID 26241, 1973.
- Nuclear Reactor Analysis, J.J. Duderstadt & L.J. Hamilton, J. Wiley & Sons, 1976.
- Nuclear Systems I & II, N.E. Todreas & M.S. Kazimi.
- Heat Transfer and Fluid Flow in Nuclear Systems, Henri Fenech, Pergamon Press Inc, 1981, ISBN 0-08-027181-2.

- Nuclear Power Plant Engineering, James H. Rust, Haralson Publishing Company, 1979, ISBN 0-934534-00-4.
- Nuclear Heat Transport, M.M. El-Wakil, Intl Textbook Co (and ANS), 1971, ISBN 0-7002-2309-6.
- Nuclear Power Plant's FSARs
- Nuclear Fuel Cycle: Analysis and Management, Robert Cochran and N. Tsoulfanadis, 1993.
- Nuclear Power Reactor Instrumentation Systems Handbook, Vol. I & II, J. M. Harrer and G.Beckerely, USAEC, 1973.
- FE & PE Review Manual
- Nuclear Reactor Kinetics, 2nd Edition, M.S. Ash, 1979.
- Radiation Detection and Measurement, 2nd Edition, G. F. Knoll, 1979.
- Radiation Shielding, J. K. Shultis and R. E. Faw, 2000.
- Nuclear Reactor Theory, Bell and Glasstone, VanNostrand Reinhold Company, New York, 1970.

+ any other textbooks you've accumulated along the way.

Required Computer

Recommended Computer Specifications: <https://it.ufl.edu/get-help/student-computer-recommendations/>
 HWCoe Computer Requirements: <https://www.eng.ufl.edu/students/advising/fall-semester-checklist/computer-requirements/>

Course Schedule

The following is a planned day-by-day schedule with maximum plausible durations noted. However, be advised that early-term disruption to the schedule (e.g.; tropical weather) will likely cause a significant reshuffle. You should not make conflicting plans between 1605 and 1800 on any Monday afternoon. Further, lectures may be moved to 1605 and 1655 on Friday afternoons. In the event that any project discussion day is cancelled, so too will be that HW.

Week	Day	Date	Due	Material
1	F	22 Aug		Introduction (1 hour)
2	M	25 Aug		Technical Communication (1 hour)
3	M	1 Sep		NO CLASS (UF HOLIDAY)
4	M	8 Sep		Computer Codes and Engineering Design Process (1.5 hours)
5	M	15 Sep	HW 1	Engineering Design Process In-Class Work (2 hours)
6	M	22 Sep	HW 2	Project Introduction and Background Information (1.5 hours)
6	R	25 Sep	HW 3	NO CLASS (Noon Deadline Only)
7	M	29 Sep		Project Groups Announced, Background Info (1.5 hours)
8	M	6 Oct	HW 4 & 5	Project Discussion 1 (2 hours)
9	M	13 Oct	HW 6	Project Discussion 2 (2 hours)
10	M	20 Oct	HW 7	Project Discussion 3 (2 hours)
11	M	27 Oct	HW 8	Project Discussion 4 (2 hours)
11	F	31 Oct	Project	Project Presentations (1 groups, 40 minutes, if needed)

12	M	3 Nov	Project	Project Presentations (3 groups – 2 hours)
13	M	10 Nov	HW 9	Project Discussion 5 (2 hours)
14	M	17 Nov		NO CLASS (ANS MEETING)
15	M	24 Nov		NO CLASS (UF HOLIDAY)
16	M	1 Dec	HW 10	Project Discussion 6 (2 hours)

Important Dates

Project Due: October 31 or November 3 (TBD based on number of project groups)

Grading

The course work will consist of two major, equally-weighted components:

- There are a total of 10 assignments in the course. These will include both individual and group work and will include in-class activities. Each is equally valuable and graded out of 100 points.
 1. Engineering Design Constraints
 2. In-class Activity Related to Engineering Design
 3. Survey to Assign Project Groups
 4. Group Division of Labor Form
 5. In-class Activity Related to Design Project (Project Discussion 1)
 6. In-class Activity Related to Design Project (Project Discussion 2)
 7. In-class Activity Related to Design Project (Project Discussion 3)
 8. In-class Activity Related to Design Project (Project Discussion 4)
 9. In-class Activity Related to Design Project (Project Discussion 5)
 10. In-class Activity Related to Design Project (Project Discussion 6)
- Project – a group report on a preliminary concept for a nuclear fission reactor. Three or four groups will be formed; each will be assigned a project significantly different than the others. For these groups, the report will detail the selection of a reactor type, application, and/or approximate power level, with these choices justified via the design process taught in class. (For example, a group might select a 200-300 MWe, pool-type, molten LBE reactor for electrical power generation in France or a 1000-1300 MWe PHWR for coupling with variable renewables.) Detailed instructions on the project will be provided in a separate document.

Grading Scale

If you receive a grade of strictly lower than 65% on the project (presentation component and written component combined -- excludes points allocated for peer review), you will receive a grade of E in the class (since you are not prepared for ENU 4192, which is the primary goal of ENU 4191.)

Else, your grade is computed as the average of your homework average (as a percentage) and your final project score (as a percentage). Final grades will be assigned based on:

Percent	Grade	Grade Points
87 - 100	A	4.00
85 - 86.99	A-	3.67
83 - 84.99	B+	3.33
75 - 82.99	B	3.00
66 - 74.99	C	2.00
0 - 65.99	E	0.00

Grading Notes

- I reserve the right to grant higher grades at the end of the course at my sole discretion, including the use of B- and C+. Under no circumstances will grades of C- or any flavor of D be used.
- Per UF policy, grades are entered into Canvas to enable you to look up grades quickly. These grades are manually copied from other documents. I reserve the right to correct data-entry errors, as well as other errors, until finalization of grades with the registrar.

Grade Appeal

All appeals of grades, including those from clerical/grade-calculation errors, must be made within 1 week of return. (This may be modified for specific assignments near the end of the term. I will announce this via e-mail as needed.) Appeals will be considered for clerical errors, addition errors, and inconsistent scoring. Grade appeals will not be entertained if you simply do not like that (for example) Part 1 was worth only 2 points with Part 2 worth 5.

It is inevitable that scoring of essay answers is somewhat subjective; a margin of error of one point per line-item is applied for this reason. That is: if you receive a grade of 7/10 on an essay-like question, only those appeals that propose a grade of 9/10 or better will be considered.

Grade appeals must be provided in the following format:

- Provide, in PDF format only, a written summary of which problem(s) or part(s) you believe were graded inaccurately. Be as specific as possible.
- Send your appeal in the form of an e-mail with (a) "ENU 4191" and (b) "Grade Appeal" in the subject line.

You will be informed of the result of your appeal via e-mail reply.

If I believe you are not acting in a good faith belief that more points are deserved, I will deem the appeal frivolous. Requests to change an essay-like line-item by only one point will also be considered frivolous. Following two frivolous appeals, your grade appeal privilege through this method will be revoked. Further appeals must be done through the petitions process, which requires formal paperwork and department/program level involvement.

Canvas and Electronic Communication

The Canvas platform will be used for file storage and for posting assignments and grades. I take no responsibility for downtime of this service, nor for actions of University of Florida staff that affect the website (including Canvas upgrades).

As discussed on the first page, do not use the Canvas Inbox feature to contact me. I only access Canvas when needed and therefore cannot guarantee rapid replies. Therefore, to avoid inconsistent responsiveness, I do not use Canvas's pseudo-e-mail at all. Instead, use real e-mail (address in that same section), which I check frequently. The primary means of communication to the class outside of class time will be e-mail listserv. This listserv will send to your @ufl.edu address only. Any inquiries regarding grading will be directed towards your @ufl.edu address only, per FERPA.

Technical and procedural questions will be answered as a reply to whatever e-mail address you used to send them. If the entire class will benefit from the answer, I may send to the class list (either in lieu of or in addition to a direct reply to you, at my discretion). If you do not wish to have a specific e-mail to me regarding technical content or course procedures replied to through the class list, you must explicitly state this in that e-mail. In such a case, I will reply directly to you and send a general-purpose announcement to the class list, not indicating who caused me to send it.

When sending questions via e-mail, please make sure you provide all the information needed for me to produce an answer or solution. This includes any files, particularly EES files, on which you are working. (Note: I will not open files from you in the following formats: .ppt, .pptx, .doc, .docx; make a PDF and send that if needed.)

Attendance and Make-Up Work Policies

Excused absences are consistent with university policies in the undergraduate catalog <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx> and require appropriate documentation.

Skip at your peril. Attendance is not directly considered in the grade. I reserve the right to take attendance to prioritize e-mail assistance.

Late-work excuses/extensions and excused absences from exams can be grouped into the categories of professional, medical, and personal.

Professional: Reasonable extensions for job/internship interviews, technical conferences, or other professional/career development reasons should be requested. Most requests are granted, excluding those that provide a student or group of students an unfair advantage, cause significant disruption to the course or grading schedule, or violate some UF policy.

Medical: Extensions will also be granted for (your own) medical reasons -- please do not come to class if you are ill. Per UF policy, in the case of medical issues that are frequent or suspiciously-timed (e.g.; you are repeatedly, suddenly ill at deadlines), I may request a signed note from a physician or similar professional practitioner.

Personal: In addition, UF policies require accommodation for several non-academic, non-medical reasons. Extensions for these personal issues are limited to those mandated by the letter of UF policies. The list of UF-approved personal reasons changes from time to time. If you have a question regarding your personal issue and if it qualifies under one of the excused absence/late-work policies, contact me in advance.

All requests for extensions, including excused absences from exams, must be submitted in writing, preferably via e-mail.

The 12-day rule will be enforced strictly. Note that the count of days is based on a per-student, not per-approved-activity basis.

One UF-allowed personal reason for absence or extension is serious accidents or emergencies affecting the student, their roommates, or their family. The word roommates is ambiguous between those with whom a student shares a residence (housemate or flatmate) and only those with whom a student shares a bedroom. For the purposes of this course, roommates shall be taken to mean those with whom a student shares a residence. Further, no definition of family is provided. Therefore, the following people shall be taken as included as family for the purposes of this course:

- Spouse, domestic partner, great-grandparent, grandparent, parent, brother, sister, child, grandchild, or the grandparent, parent, brother, sister, child, grandchild, or great-grandchild of the student's spouse or domestic partner, or the spouse or domestic partner of any of them. This also includes individuals for whom the student is the current legal guardian. These are based on the UF definition of immediate family, which can be accessed at: http://benefits.hr.ufl.edu/wp-content/uploads/sites/3/2018/05/immediate_family_defs.pdf. Note that the term domestic partner does not apply automatically to any partner with whom you cohabitate (formal registration with UF is required). That is, if you have not registered with UF, an accident involving your partner would count, but not one involving your partner's parent, child, etc.
- Your own aunt/uncle, great-aunt/uncle, nibling (niece or nephew), or great-nibling.

More distant relatives (a cousin, your spouse's nibling, etc.), partners (excluding spouses or those with whom you cohabitate), friends (other than roommates), and pets are not included. Minor illnesses (guideline: anything meriting home care only or care at a walk-in clinic, as opposed to an ER) of family members, including minor children, do not count as emergencies, nor do events such as birthdays, anniversaries, weddings, etc.

Political activities, including protests, demonstrations, and the like are considered personal matters and not generally permitted as reasons for extensions. This includes activities related to nuclear engineering or nuclear power. Exceptions: (1) if you are pursuing nuclear-related (whether pro- or anti-) politics as a career path, you may be granted extensions, at my discretion, on condition of providing evidence of bona fide efforts to secure a full-time position or to secure admission to a relevant, non-STEM degree-granting graduate program and (2) activities between November 8 and 13, inclusive, that are connected to the 2025 ANS Winter Conference and Expo will be taken as related to those professional activities and potentially grounds for extensions.

Further, be advised that any approved reasons for extensions do not reduce the amount of work you are required to complete, but merely rearranges the timing. For those issues that are predictable (interview, holidays, etc.), you should work ahead to avoid disruption. In the case where your extension (or other accommodation) adversely affects a group project, I may modify the assignment and/or groups for those concerned to minimize the disruption of one student's issues on other group members.

Homework and Projects

Please note that there is no unexcused late work, reduced credit policy in this course. ***Late = zero credit.***

Homework must be submitted electronically (via Canvas) or in hard copy. The Canvas deadline will vary from assignment to assignment (tentatively: 2359 for HW 1-3; noon for HW 4; at the time of your group's discussion for HW 5-10. Evaluation of HW 5-10 will include any submissions (hard-copy or electronic) as well as an in-class discussion.

The project must be written using word processing or typesetting software and submitted electronically via Canvas. Professional document and figure standards will be enforced the project. The onus is on you to figure out how to meet these standards in whatever programs you use to write the document and make figures. I have exactly zero sympathy for those who select a word processor without knowing how to format their text using it – complaints that the standards are not the same as a particular piece of software's defaults will not lead to a revision of requirements or grading.

The following restrictions apply for electronic submissions:

- Submissions may include multiple files, but only files with the following extensions will be accepted: pdf, xls, xlsx, ods, numbers, ees, txt, and (for the Projects only) zip. This zip archive may not contain any ppt, pptx, doc, or docx files. Such files will be ignored for the purposes of grading.
- If a hard copy and electronic submission are provided on a homework, the hard copy will take precedence. (Only it will be read, reviewed, and graded.) You may not submit parts of the assignment electronically and parts in hard copy.
- If multiple students in a Project group independently submit to the same deadline, the submission by the student whose name is listed earlier on the assignment that I post to Canvas will take precedence. (One student must submit the entire project -- different students submitting the project narrative and supporting zip archive is not allowed.)

The following restrictions apply for hard-copy submissions as well as electronic submissions of scanned handwritten work:

- Use pencil or black/dark-blue ink and either white paper (lined or not) or engineering paper.
- Use a one-column layout. Each problem should appear beneath the previous or on a new sheet of paper, not next to other problems.
- Submissions, or any part thereof, that are unreadable will earn zero credit.
- Submissions that are only readable with unusual effort, difficulty, or unpleasantness (e.g.; text too small to read comfortably, writing too light to see with normal indoor illumination, poor penmanship, etc.) and those that violate the first and/or second bullet point in this list will be subject to a 10% deduction for the first instance, followed by a 30% deduction for the second, and zero credit for the third and further instances. These progressive penalties apply to these issues as a set. For example, a 10% penalty for a multi-column layout will be followed by a 30% penalty for homework submitted on bright orange paper.

Collaboration

Projects will be done in groups. I will assign the groups. A peer review system is in place with a goal of equal workload among students in each group. In the event the workload is significantly unequal, I reserve the right to adjust individual grades to accurately reflect contributions to the work.

The ground rules for collaboration should be decided by each group through compromise and consensus. However, regardless of the preferences of the group as a whole, each of you retains the individual right to privacy and to maintain good mental and physical health. To this end, no one shall be compelled:

- To join a real-name social networking site or modify their existing use of such a site, or
- To accept a 24/7 or other onerous on-call policy.

That is: each member holds a unilateral veto on using Facebook (or some such) for your group's work or for being contacted at all hours of the day and night.

Inter-personal issues within your group stemming from deciding group rules must be brought to me promptly for arbitration. This arbitration will focus on the guidelines above with a goal of equal marginal/new inconvenience among group members and not on determining whose activities outside this course (including personal pursuits, situations, and choices) are more meritorious.

No collaboration is permitted between groups on Projects.

Letters of Recommendation

To request a letter of recommendation/evaluation (for graduate school or otherwise), you must provide (all in a single e-mail):

- A copy of your UF transcript.
- A copy of your résumé (or CV).
- A copy of the following form with all four circles checked (requests with three or fewer circles checked will be denied): <http://www.registrar.ufl.edu/pdf/ferparelease.pdf>.

Letters are typically filed once per week. For those of you whom I know only through coursework, my letter typically focuses on an estimate of their rank-in-class and on their performance on projects and challenging problems.

I will only file one batch of letters for each of you during the term. (This policy is designed to keep me from looking up slight changes in your rank/performance multiple times for multiple batches of letters.) I recommend that this batch occur as late as possible in the term to allow me sufficient information (sample size) on your performance to write a useful letter.

I reserve the right to refuse to provide a letter for anyone and am not obligated to provide a reason for such refusal.

Ph.D. Applications – The first duty of every Ph.D. holder is to the truth, whether it is scientific truth or historical truth or personal truth! It is the guiding principle on which inquiry is based, and if you can't find it within yourself to stand up and tell the truth about what happened, you don't deserve to have that degree! (adapted from Captain Picard). If I have ever caught you in a lie, no matter how small, do not presume that I will write you a letter of recommendation for Ph.D. programs until we have discussed your transgression.

The remaining sections are Syllabus Boilerplate and were written by people other than your instructor. Questions on these items will usually be referred to the responsible level/office within the university, which will take longer than for the sections written by your instructor

Academic Policies & Resources

To support consistent and accessible communication of university-wide student resources, instructors must include this link to academic policies and campus resources: <https://go.ufl.edu/syllabuspolices>. Instructor-specific guidelines for courses must accommodate these policies.

Commitment to a Positive Learning Environment

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values.

If you feel like your performance in class is being impacted, please contact your instructor or any of the following:

- Your academic advisor or Undergraduate Coordinator
- HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu