NE585
Nuclear Fuel Cycles
University of Idaho · Idaho Falls Center for Higher Education
Department of Nuclear Engineering and Industrial Management

Syllabus

Objective. Provide the fundamental knowledge basis for advanced study into the nuclear engineering field.

Content. The focus of this course is on fundamental nuclear engineering principles and how these are practically applied to the contemporary and advanced nuclear fuel cycles. The topics covered in this course include nuclear fuel cycle analysis, back end management, neutronics modeling, recycling, advanced reactor design, nonproliferation, and risk assessment and safety. A focal module of the course is developing facility with MCNP.

Learning Outcomes. In this course, students will –

- Explain the different components of the nuclear fuel cycle within the context of energy production
- Generate critical core design configurations mathematically and with MCNP
- Interpret the social, political, and technical issues surrounding back end management of the nuclear fuel cycle.

Delivery. Class will be in person each week. Assignments will typically be due at the next class period but will be stipulated. Submission will be through email for the time being until the course is transferred to Canvas. All materials will be stored on piazza currently until the course is transferred to Canvas. Students are expected to check the course site periodically for any updates, news, and discussions.

Literature. Some of the lecture material will be based on the Lamarsh textbook. The other listed textbooks are only for reference and just good to have for a career in nuclear engineering. There are two online 'textbooks' stored on the University site – Principles of Nuclear Engineering and Risk Assessment. The former contains a lot of material, especially pertaining to MCNP. Each of these contain open source literature and lecture content to supplement the nuclear engineering curriculum and are free to use. Additional course literature will be available on piazza.

(1) Introduction to nuclear engineering, John R. Lamarsh, ISBN 0-201-14200-7 (1983). [*any version*]
(2) Fundamentals of nuclear science and engineering, J. Kenneth Shultis, Richard E. Faw, ISBN 0-8247-0834-2 (2002)
(3) Nuclear chemical engineering, M. Benedict, T. H. Pigford, H. W. Levi, ISBN 0-07-004531-3 (1981)

Communications. Piazza will be used for now for regular questions and discussions related to the course. Personal issues can be discussed over email. Meetings can also be made by appointment.

Professionalism. Review the Code of Student Conduct pertaining to cheating and plagiarism. Realistically, professional engineering work is team-oriented. While it is ok to work in groups, students will submit their own original work for the course.

Civility. Conversation and dialogue about the course both online and in person is encouraged. Everyone in this course will be treated with mutual respect and civility. The instructor will moderate all discussion and make the final decision on any contentious content. Additional resources to request support include –

- Office of the Dean of Students
- Counseling & Testing Center
- Office of Equity and Diversity
- Office of Civil Rights and Investigations

Respect for Diversity. The diversity that students bring to this class is a resource, strength and benefit. Course materials and related content have been curated to be respectful of gender, sexual orientation, disability, age, socioeconomic status, ethnicity, race, culture, perspective, and other background characteristics. Any suggestions to improve the value of diversity in this course are encouraged and appreciated.

Disability Access and Reasonable Accommodations. The University of Idaho is committed to ensuring an accessible learning environment where course or instructional content are usable by all students and faculty. If you believe that you require disability-related academic adjustments for this class (including pregnancy-related disabilities), please contact Center for Disability Access and Resources (CDAR) to discuss eligibility. A current accommodation letter from CDAR is required before any modifications, above and beyond what is otherwise available for all other students in this class will be provided. Please be advised that disability-related academic adjustments are not retroactive. For a complete listing of services and current business hours visit the Center for Disability Access and Resources.

Prerequisites. NE450 or Instructor permission. Students should have facility in the typical skills acquired in any accredited undergraduate engineering curriculum –

- Chemistry
- Physics
- Calculus
- Differential equations
- Linear algebra
- Engineering mathematics
- Technical writing
- Thermodynamics
- Heat transfer

Additional recommended skills include –

- Command line
- Python
- Matlab or equivalent
- Scientific and engineering graphing skills
- LaTex (templates provided)

Assignments & grading.

Homework – 0.50
Design project report – 0.48
Design project presentation – 0.02