

NRE 6501 – NUCLEAR FUEL CYCLE

Credit Hours:	3–0–3
Prerequisites:	NRE 6201 or equivalent, or with the consent of the instructor
Prerequisite by Topic:	Reactor physics
Catalog Description:	Fission nuclear fuel cycle, uranium mining and milling, enrichment. Fuel fabrication. In-core fuel management. Reprocessing and fuel cycle economics. Spent-fuel waste management.
Textbook:	Lecture notes and posted materials
Instructor:	Bojan Petrovic
Goals:	Present an overview of the entire nuclear fuel cycle. Identify and discuss issues related to once-through, modified once-through, and closed fuel cycle. Introduce tools for fuel depletion analysis. Develop understanding of techno-economical issues and possible approaches to fuel cycle optimization.
References:	M. Benedict, T.H. Pigford and H.W. Levi, <i>Nuclear Chemical Engineering</i> , 2 nd ed., McGraw-Hill, New York, NY, 1981. <i>America's Energy Future: Technology and Transformation</i> , The National Academy Press, 2009. N. Tsoulfanidis, <i>The Nuclear Fuel Cycle</i> , American Nuclear Society, La Grange Park, IL, 2013., or, R.G. Cochran and N. Tsoulfanidis, <i>The Nuclear Fuel Cycle: Analysis and Management</i> , 2 nd ed., American Nuclear Society, La Grange Park, IL, 1999. P.D. Wilson (Ed.), <i>The Nuclear Fuel Cycle: From Ore to Waste</i> , Oxford Science Publications, 1999. M.J. Driscoll, T.J. Downar, E.E. Pilat, <i>The Linear Reactivity Model for Nuclear Fuel Management</i> , American Nuclear Society, La Grange Park, IL, 1990.
Topics:	<ol style="list-style-type: none"> 1. Fuel cycle overview 2. Nuclear fuel resources and sustainability 3. Uranium exploration, mining and milling 4. Conversion and enrichment 5. Fuel fabrication 6. Open-, modified open- and closed fuel cycle 7. Fuel reprocessing 8. U-Pu and Th-U fuel cycle 9. Fuel cycle of main reactor types 10. Fuel depletion analysis; LRM and NLRM 11. In-core fuel management 12. Out-of-core fuel management 13. Spent nuclear fuel management 14. Economics of fuel cycle 15. Special topics