Jordan University of Science and Technology
Faculty of Engineering
Nuclear Engineering Department

NE465 Nuclear Reactor Materials
First Semester 2019-2020

Course Catalog
3 Credit Hours. Nuclear reactor materials, fuel element, fission gas swelling, void swelling, materials thermal properties, chemical behavior and radiation damage. Displacements cascades damage and crystal effect, collective effects and damage, sputtering, point defect formation and diffusion, defects reaction theory, hardening, embrittlement, and irradiation creep.

Text Book	
Title	Fundamental Aspects of Nuclear Reactor Fuel Elements
Author(s)	D.R. Olander.
Edition	2nd Edition
Short Name	Ref #1
Other Information	

Course References

Short name	Book name	Author(s)	Edition	Other Information
Ref #2	Fundamentals of Radiation Materials Science	Gary S. Was,	1st Edition	
Ref #3	Ion-Solid Interactions: Fundamentals and Applications	M. Nastasi, J.W. Mayer, and J.K. Hirvonen.	2nd Edition	
Ref #4	Materials Science and Engineering: An Introduction	W.D. Callister,	3rd Edition	

Instructor	
Name	**Dr. GHADEER AL-MALKAWI**
Office Location	-

Office Hours	Sun : 09:30 - 10:30 Sun : 12:30 - 13:30 Tue : 09:30 - 10:30 Tue : 12:30 - 13:30 Wed : 13:15 - 14:15 Thu : 09:30 - 10:30 Thu : 12:30 - 13:30
Email	ghmalkawi@just.edu.jo

Class Schedule & Room
Section 1: Lecture Time: Sun, Tue, Thu : 10:30 - 11:30 Room: E2117

Prerequisites

Line Number	Course Name	Prerequisite Type
293630	IE363 Engineering Materials	Prerequisite / Study
2003400	NE340 Nuclear Reactors Theory	Prerequisite / Study

Tentative List of Topics Covered

Weeks	Topic	References
Weeks 1, 2	Mechanical Properties of Metals and Interatomic Bonding.	
Week 3	Aspects of Radiation Effects	
Week 3	General Requirements for the nuclear reactor materials	
Weeks 4, 5	Diffusion in nuclear processes (macroscopic and microscopic view of diffusion)	
Weeks 5, 6	Thermodynamics of Point Defects Formation	
Weeks 7, 8	Kinchin Pease Model for Displacement	
Weeks 8, 9	Sputtering	
Weeks 10, 11	Swelling and Void Formation	
Week 12	Irradiation Creep	
Week 13	Embrittlement	

Mapping of Course Outcomes to Program Student Outcomes	Course Outcome Weight (Out of 100%)	Assessment method
A basic understanding of physical metallurgy and of the relationship between material microstructure and macroscopic behavior, outside of irradiation. [11]	10%	First Exam, Quizzes

An understanding of the mechanisms of radiation-material interaction with different types of radiation types and parameters. [11]	22%	First Exam, Second Exam, Quizzes
Studying the microscopic and macroscopic diffusion of atoms and Freckle pairs and enabling the students to calculate the concentration of the point defects [11]	18%	First Exam, Second Exam, Quizzes
An understanding of the basic mechanisms of materials degradation induced by neutron irradiation and the reactor environment including processes such as swelling, creep, phase transformations and embrittlement. [21, 12]	50%	Second Exam, Quizzes

Relationship to Program Student Outcomes (Out of 100%)						
1	2	3	4	5	6	7
83.33	16.67					

Evaluation	
Assessment Tool	**Weight**
First Exam	25%
Second Exam	25%
Quizzes	10%
Final Exam	40%

Policy	
Attendance	Since class discussion is a major course ingredient, regular attendance is mandatory. Attendance record will be taken into consideration in any borderline grade decisions.
Exam Policy	There will be no make-up exams except in extreme circumstances at the discretion of the instructor. The instructor has to be informed in advance (by email, phone, personal ...). You will be asked to provide proper documentation.
Disabled Students	Students with any sort of limitation or disability should discuss its consequences with instructor prior to the start of the course.
Emergency Provisions	In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor?s control. Here are ways to get information about changes in this course: - E-learning announcements - Instructor email (ghmalkawi@just.edu.jo)

Date Printed: 2020-01-14

Nuclear fuel is material used in nuclear power stations to produce heat to power turbines. Heat is created when nuclear fuel undergoes nuclear fission. Most nuclear fuels contain heavy fissile actinide elements that are capable of undergoing and sustaining nuclear fission. The three most relevant fissile isotopes are uranium-233, uranium-235 and plutonium-239. When the unstable nuclei of these atoms are hit by a slow-moving neutron, they split, creating two daughter nuclei and two or three more Fundamentals of Nuclear Reactor Physics(2008).pdf. 269 PagesÂ·2008Â·2.72 MBÂ·6,388 Downloads. ., Introduction to Nuclear Reactor Theory, Addison-. Wesley Nuclear Physics: Exploring the Heart of Matter. 276 PagesÂ·2013Â·672 KBÂ·102,671 DownloadsÂ·New! of the field and then to take a long-term strategic view of U.S. nuclear science in the global context Fundamental Aspects of Nuclear Reactor Fuel Elements - Solutions to Problems. 572 PagesÂ·2006Â·15.4 MBÂ·24 Downloads. Nuclear Reactor. Fuel Elements. Solutions to Problems. Donald R. Olander. Safety aspects of nuclear reactor - Deep Blue. Reloading Nuclear Reactor Fuel USing Mixed-Integer. May 2, 2000 - Delft University of Technology.Â The most important metallic component of a reactor core is the fuel cladding; this member provides structural integrit~I to the fuel element, prevents fission products from escaping tu the primary coolant system, and separates the sodium coolant from the ceramic oxide fuel (with which it reacts). The cladding must be thin-walled tubing that can remain intact in a fast reactor environment for perinds of up to 3 years at temperatures to 800-C, diametral strains of 3â€œ;, and Iluences up tu 3 x 102 ~ neutrons cn-~ seeâ€-â€™ The cladding alloy selected for the LYIFBR is the austenitic stainless steel d