



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

NE465 Nuclear Reactor Materials - JNQF Level: 7

First Semester 2024-2025

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.

Teaching Method: On Campus

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	E1L2

Office Hours	
Email	ghmalkawi@just.edu.jo

Class Schedule & Room
Section 1: Lecture Time: Sun, Tue, Thu : 09:30 - 10:30 Room: E2113

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	
Weeks 13, 14	Projects Presentations	

Mapping of Course Outcomes to Program Outcomes and NQF Outcomes	Course Outcome Weight (Out of 100%)	Assessment method
Students will be able to understand physical metallurgy and the relationship between material microstructure and macroscopic behavior, outside of irradiation. [1SO1] [1L7K1]	14%	
Students will be able to explain the mechanisms of radiation-material interaction with different types of radiation and parameters. [1SO1] [1L7K1]	23%	

Students will be able to calculate the concentration of the point defects by linking the microscopic and macroscopic diffusion of atoms and Freckle pairs [1SO1] [1L7K1]	14%	
Students will be able to examine the effect of material degradation induced by neutron irradiation and the reactor environment including processes such as sputtering, swelling, creep, phase transformations, and embrittlement. [1SO1, 1SO2] [1L7S3]	49%	

Relationship to Program Student Outcomes (Out of 100%)						
SO1	SO2	SO3	SO4	SO5	SO6	SO7
75.5	24.5					

Relationship to NQF Outcomes (Out of 100%)	
L7K1	L7S3
51	49

Evaluation	
Assessment Tool	Weight
First Exam	30%
Second Exam	25%
Final Exam	40%
Project	5%

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: 2024-10-05