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

NE340 Nuclear Reactors Theory - JNQF Level: 7
Second Semester 2024-2025

Course Catalog
3 Credit Hours. Review on neutron interactions, center of mass system, differential cross-section, compound nucleus formation model, optical model, theory of total neutron cross-section, Doppler broadening, neutron current and flux, neutron transport theory, one-speed neutron diffusion theory, neutron moderation in hydrogenous and non-hydrogenous medium, slowing down density , conditions for criticality of nuclear reactors, Four and six-factor formula, neutrons economy, infinite reactor, reflector saving, and boundary conditions.
Teaching Method: Blended

Text Book	
Title	Nuclear Reactor Analysis
Author(s)	J.J. Duderstadt and L.J. Hamilton
Edition	1st Edition
Short Name	Ref #1
Other Information	

Course References

Short name	Book name	Author(s)	Edition	Other Information
Ref #2	Introduction to Nuclear Reactor Theory	John R. Lamarsh	1st Edition	

Instructor	
Name	**Prof. Khaled AL-Shboul**
Office Location	E2 L-2
Office Hours	
Email	kfshboul@just.edu.jo

Class Schedule & Room

Section 1:
Lecture Time: Sun, Tue : 11:00 - 12:00
Room: LAB

Prerequisites		
Line Number	**Course Name**	**Prerequisite Type**
2002060	NE206 Introduction To Nuclear Engineering	Prerequisite / Pass

Tentative List of Topics Covered		
Weeks	**Topic**	**References**
Week 1	An Introduction to Nuclear Power Generation	**Ch 01** From **Ref #1**
Weeks 2, 3	The Nuclear Physics of Fission Chain Reactions	**Ch 02** From **Ref #1**
Weeks 4, 5, 6	Neutron moderation with and without absorption	**Ch 08** From **Ref #1**, **Ch 06 & Ch 07** From **Ref #2**
Weeks 6, 7, 8	Fission Chain Reactions and Nuclear Reactors	**Ch 03** From **Ref #1**
Weeks 9, 10, 11	Neutron Transport	**Ch 04** From **Ref #1**
Weeks 12, 13, 14, 15	The One-Speed Diffusion Theory Model	**Ch 05** From **Ref #1**

Mapping of Course Outcomes to Program Outcomes and NQF Outcomes	Course Outcome Weight (Out of 100%)	Assessment method
To demonstrate a fundamental understanding of the center of the mass system and differential scattering crosssections. [1SO1, 1SO2] [1L7K1]	15%	
To understand the four and six factors formulas used to determine the reactor multiplication factor. [1SO1, 1SO2] [1L7K1]	15%	
To demonstrate a solid understanding of fundamental transport concepts such as neutron density, neutron scalar flux, neutron current density. [1SO3, 1SO4, 1SO5] [1L7C2]	20%	
To understand how to calculate neutron interaction probabilities density. [1SO3, 1SO4, 1SO5] [1L7C1]	10%	
To be able to derive the neutron transport equation and the neutron diffusion equation. [1SO6, 1SO7] [1L7C4]	15%	
To understand how to solve the one group diffusion equations for certain core geometries. [1SO1, 1SO2, 1SO6, 1SO7] [1L7S3]	25%	

Relationship to Program Student Outcomes (Out of 100%)						
SO1	SO2	SO3	SO4	SO5	SO6	SO7
21.25	21.25	10	10	10	13.75	13.75

Relationship to NQF Outcomes (Out of 100%)				
L7K1	L7S3	L7C1	L7C2	L7C4
30	25	10	20	15

Evaluation	
Assessment Tool	**Weight**
First Exam	30%
Second Exam	30%
Final Exam	40%

Policy	
Quizzes	Quizzes will be given at the end of selected classes to measure understanding of the basic principles.

Date Printed: 2025-02-25