

NE 511: Multi-Physics of Nuclear Reactors
Spring 2026

Course Schedule

Course Topics		Assignments
TOPIC # 1 - INTRODUCTION & FUNDAMENTALS OF REACTOR MULTI-PHYSICS		
01/13/26	Welcome to NE 511: Multi-Physics of Nuclear Reactors Basic Topics and Nomenclature	
01/15/26	Time-Dependent Phenomena in Nuclear Reactors Multi-Physics Interactions in Reactor Core Classification of Multi-Physics Modeling and Simulation Tools	
TOPIC # 2 - SHORT-TIME MULTI-PHYSICS PHENOMENA IN REACTOR CORE		
01/20/26	Dynamic Equation & Simplified Neutron Cycle Prompt and Delayed Neutrons Total Delayed Neutron Yields & Yields of Delayed Neutron Groups	
01/22/26	Emission Spectra of Delayed Neutrons Theoretical Background for Calculation of Kinetics Data	Quiz #1
01/27/26	NO LIVE CLASS; SELF-WORK TO BE ASSIGNED	
01/29/26	NO LIVE CLASS; SELF-WORK TO BE ASSIGNED	
02/03/26	Preliminary Formulation of the Point Kinetics: <i>Prompt Neutron Balance Equation</i> <i>Intuitive Point Kinetics Equation</i> <i>One-Group Point Kinetics Equation</i>	
02/05/26	Reactivity in the Exact PKEs; Effective Delayed Neutron Fractions Point Reactor Model	Quiz #2 HW1: Prompt and Delayed Neutron Phenomena
02/10/26	Prompt Reactivity Feedback Phenomena: Core Power Models and Fuel Temperature Calculations Course Project Assignment and Discussions & Tasks	
02/12/26	Prompt Reactivity Feedback Phenomena: Transient at Small Times	Quiz #3 HW1 Due
02/17/26	NO CLASSES - WELLNESS DAY	
02/19/26	NO LIVE CLASS; SELF-WORK TO BE ASSIGNED	
02/24/26	Prompt Reactivity Feedback Phenomena: Asymptotic Transients	
02/26/26	Superprompt-Critical Excursion Following Step Reactivity Insertion	
03/03/26	Superprompt-Critical Excursion Following Ramp Reactivity Insertions	HW2: Reactivity Feedback
03/05/26	Delayed Reactivity Feedback Phenomena: Moderator / Coolant Feedback Effects	

03/10/26	BWR Instabilities; General Reactor Stability	Quiz #4 HW2 Due
TOPIC # 3 – LOW FIDELITY MULTI-PHYSICS MODELING		
03/12/26	Simplified Multi-Physics Coupling Schemes Thermal-Hydraulics with Point Kinetics Feedback	
03/12–15/26	EXAM 1 PERIOD: SHORT-TIME MULTI-PHYSICS AND DELAYED REACTIVITY FEEDBACK	
03/16 - 20/26	SPRING BREAK – NO CLASSES	
03/24/26	Neutronics with 1D Thermal-Hydraulics Feedback Fuel Performance with Neutronics and Thermal-Hydraulics Feedback	HW3: Multi-physics modeling
03/26/26	Thermal-Hydraulics with 3D Nodal Kinetics Feedback Heat Conduction and Fuel Rod Modeling in Thermal-Hydraulic Codes	Quiz #5
03/31/26	Space-Energy Dependent Dynamics: General Discussion of the Dynamics Problem; Flux Factorization	Quiz #6 HW3 Due
04/02/26	Space-Energy Dependent Dynamics: Quasi-Static Methods & Dynamic Reactivity Coefficients	
04/07/26	Course project discussions (students' presentations)	
04/09-12/26	EXAM 2 PERIOD - TRADITIONAL REACTOR MULTI-PHYSICS MODELING	
TOPIC # 4 – HIGH FIDELITY MULTI-PHYSICS MODELING		
04/09/26	High-Fidelity Neutronics, Thermal-Hydraulics and Fuel Performance models; Feedback Parameters	
04/14/26	Multi-Scale Single Physics Modeling Using Hi2Lo Information Schemes and Implementation within Multi-Physics Calculations	
04/16/26	Spatial & Temporal Coupling - Multi-Physics Platforms	Quiz #7
04/21/26	NO CLASS / TEAM-WORK ON THE PROJECT	
04/23/26	NO CLASS / TEAM-WORK ON THE PROJECT	
04/28/26	Verification and Validation of Multi-Physics Simulations Uncertainty Quantification in Multi-Physics Modeling COURSE WARP-UP	
04/30 – 05/06/26	FINAL EXAMS PERIOD: › NO FINAL EXAM › MAKE-UP QUIZ (BY REQUEST)	PROJECT REPORT DUE 04/30/2026