Tentative Schedule:

LEC #	DATE	TOPICS	NOTE
1	8/24/2021	Introduction, course overview, materials basics: crystallography, defects	
2	8/26/2021	Radiation effects	
3	8/31/2021	Radiation damage quantification: dpa, rpa, stopping powers, models for defect generation, difference in radiation types (injected ions, activation, cascade, etc)	
4	9/2/2021	Radiation damage quantification cont'd	HW1: radiation damage quantification
5	9/7/2021	Radiation damage quantification tutorials (SRIM & IM3D)	
6	9/9/2021	Atomic diffusion: diffusion mechanism, Fick's law, diffusivity formulation, Arrhenius law	
7	9/14/2021	Molecular dynamics (MD): theory, interatomic potentials, implementation	
	9/16/2021	MD cont'd	HW2: diffusion and defect energetics
8	9/21/2021	MD: thermodynamics quantities evaluation	
	9/23/2021	MD: radiation damage	
9	9/28/2021	MD: defect energetics	
10	9/30/2021	MD: diffusion	HW3: defect diffusion and damage cascades
13	10/5/2021	Review for midterm	
14	10/7/2021	Midterm exam	Midterm exam
15	10/12/2021	Accelerated MD: theory and applications	Research idea summary
16	10/14/2021	Accelerated MD: theory and applications	
17	10/19/2021	Rate theory: background	HW4: defect kinetics questions, temperature effect, dose rate effect
18	10/21/2021	Rate theory: point defect kinetics	
19	10/26/2021	Rate theory: voids, dislocation loops, bubbles	Term paper abstract and outline
20	10/28/2021	Rate theory: voids, dislocation loops, bubbles cont'd	
21	11/2/2021	Rate theory: segregation and precipitation (kinetics and thermodynamics)	
22	11/4/2021	Kinetic Monte Carlo (KMC): theory (off-lattice and on-lattice)	HW5: simulating microstructural evolution
23	11/9/2021	KMC theory cont'd	
24	11/11/2021	KMC: microstructural evolution	Term paper progress meeting
25	11/16/2021	KMC: microstructural evolution	

26	11/18/2021	KMC: microstructural evolution	
	11/23/2021		No class
	11/25/2021		No class
27	11/30/2021	Fuel performance multi-physics coupling intro	
28	12/2/2021	Fuel performance multi-physics coupling cont'd	
29	12/7/2021	Term project presentation	Term paper due
30	12/9/2021	Term project presentation	

* Schedule subject to change.

Notes:

1. Reading:

Supplementary materials (if any) will be distributed at least one week before the corresponding topics. Reading the assigned materials before coming to the class will significantly enhance your understanding in class. Teaching will be carried forward assuming you have completed the reading.

2. Late policy:

The assignments are reasonably designed to be finished before the due time. Late homework or term paper is only accepted due to extended emergency/illness (documented).

3. Term Project:

The topic of a project is flexible under the scope of this course. The work must show originality. Examples are:

- Literature survey with supporting calculations for your own hypothesis.
- Simulations designed to explore a topic in depth.
- Simulations backed with a simple experiment.

There will be two parts:

- Term paper: Regular article, less than 5000 words, including all text (i.e., abstract, manuscript text, captions, references, footnotes, etc.).
- Presentation: Each presentation about 15 mins, with additional 10 mins for questions.