MATSCEN 3321 (Approved): Modeling and Simulation Lab II

Course Description
An introduction to modeling and simulation techniques appropriate to junior-level study in materials science and engineering.

Transcript Abbreviation: Mod Sim Lab II
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Undergrad
Student Ranks: Junior
Course Offerings: Spring
Flex Scheduled Course: Never
Course Frequency: Every Year
Course Length: 14 Week
Credits: 2.0
Repeatable: No
Time Distribution: 2.0 hr Lec
Expected out-of-class hours per week: 4.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: Prerequisites: MSE3141, MSE3151, Calculus I & II
Co-requisites: MSE3261, MSE3271
or permission of instructor.
Exclusions:
Cross-Listings:

The course is required for this unit's degrees, majors, and/or minors: Yes
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: No

Subject/CIP Code: 14.1801
Subsidy Level: Baccalaureate Course

Programs

Abbreviation	Description
MATSCEN	Materials Science and Engineering

Course Goals

Visualize phenomena, conduct virtual experiments, and use modeling and simulation techniques that provide quantitative engineering estimates related to material structure, processing, and properties.
Introduce students to transport and kinetics modeling and simulation; elementary case studies.
Introduce students to structural transformations modeling and simulation; elementary case studies.
Introduce students to electronic/optical properties modeling and simulation; elementary case studies.
Introduce students to structural properties modeling and simulation; elementary case studies.
Define limitations to models and simulations and methods by which to assess accuracy.

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Lab A. Introduction to transport and kinetics modeling and simulation: Representative Examples: Steady-state and non-steady-state diffusion; case studies; e.g., MatLab, COMSOL.	7.0							
Lab B. Introduction to structural transformations modeling and simulation: Representative Examples: Prediction of volume fraction of product phase/precipitate during a specified cooling history; case studies; e.g., MatLab, PANDAT/PanPrecipitation.	7.0							
Lab C. Introduction to electronic/optical properties modeling and simulation: Representative Examples: Band structures, optical properties, and simple device structures; case studies; e.g., NanoHub.	7.0							
Lab D: Introduction to structural properties modeling and simulation: Representative Examples: precipitate strengthening; percolation of yield throughout a polycrystal; yield around a crack tip; case studies; e.g., MatLab, COMSOL.	7.0							

Representative Assignments

Lab A: Diffusion processing of a doped semiconductor or carburized gear.
Lab B: Conditions for optimal precipitate distribution.
Lab C: Real-space band structure at a p-n junction as a function of dopant concentration.
Lab D: Elastic stress state around a hole or a crack tip.

Grades

Aspect	Percent
In-class assessment	40%
Homework and Course Projects	60%

Representative Textbooks and Other Course Materials

Title	Author
Manual: Comsol Software	
Manual: PANDAT Software	
NANOHUB Software	
MATLAB Software	

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
***	a	An ability to apply knowledge of mathematics, science, and engineering.
**	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
**	c	An ability to design a system, component, or process to meet desired needs.

Course Contribution		College Outcome
	d	An ability to function on multi-disciplinary teams.
**	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.
	g	An ability to communicate effectively.
	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
	i	A recognition of the need for, and an ability to engage in life-long learning.
	j	A knowledge of contemporary issues.
***	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

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