

AMES 5111: Computer Aided Engineering

Credits: 3 Credits, 3 contact hours/week

Instructor: Team-taught (Dongare, Pasaogullari, Valla, Zhang)

Textbook: None required, course notes and materials will be distributed.

Catalog Description: Introductory course on computational methods in design and analysis of materials, processes, and systems, related to advanced manufacturing and energy systems. Topics covered include computational materials (DFT, MD etc.), process simulation, computational fluid dynamics, finite element analysis, manufacturing process simulation ...

Prerequisites: Graduate standing

Course Objectives/Outcomes:

After completing AMES 5111, students will:

- Be generally familiar with computational methods and computer tools used in analysis and design of materials, processes and systems;
- Understand the underlying assumptions for each individual approach;
- Be able to choose the correct approach, tool and method for various problems;
- Be able to conduct elementary analysis using each tool covered.

List of Topics:

Computational Materials

Density functional theory, classical molecular dynamics simulations, Monte Carlo simulations, Mesoscale modeling methods

Process Simulation

Material and Energy Balances, Thermodynamic properties of fluids, Unit operations (turbines, compressors, heat exchangers, pumps), Reactors

Manufacturing Systems Simulation

Discrete-event simulations, queueing systems, probabilistic distribution fit, simulation software application (Simul8)

Computational Fluid Dynamics

Discretization Methods, Navier-Stokes solutions, Numerical Algorithms, Mesh Generation, Post-processing

Finite Element Analysis

Discretization Methods, Weighted residuals and Galerkin formulation, FEM in multi-dimensional problems, Applications in solid and fluid mechanics

Assessment/Grading: Projects, Homeworks, Final exam:

Academic integrity: All forms of academic misconduct are prohibited. The Undergraduate Academic Integrity policy regarding academic misconduct states, “Academic misconduct is dishonest or unethical academic behavior that includes, but is not limited, to misrepresenting mastery in an academic area (e.g., cheating), failing to properly credit information, research or ideas to their rightful originators or representing such information, research or ideas as your own (e.g., plagiarism)”.

Course Website: All course material (syllabus, supplemental materials, homework assignments, etc.) will be uploaded on HuskyCT.