## PURDUE UNIVERSITY. FORT WAYNE Civil and Me Engineering

## Department of Civil and Mechanical

Course	ME 54400 - Modeling and Simulation of Mechanical Engineering Systems
Type of Course	Graduate Elective (Group 1) for ME program
Catalog Description	Modeling and simulation paradigms and methodologies applied to mechanical engineering systems. Emphasis is on model development, computer implementation, numerical solution, and verification & validation. Examples illustrating design decision models and life-cycle analysis are presented. Engineering applications include manufacturing, static, dynamic, energy, and thermal-fluid systems.
Credits	3
Contact Hours	3
Prerequisite Courses	Graduate standing (with mechanical engineering or closely-related background), or ME 30100, 32100, 33100, & 36900 with C or better, or permission of instructor.
Corequisite Courses	Undergraduate students should be currently in or have completed senior design.
Prerequisites by Topics	Required coursework for an undergraduate degree in mechanical engineering.
Textbook	D. K. Chaturvedi, <i>Modeling and Simulation of Systems Using MATLAB and Simulink,</i> CRC Press, current edition.
Course Objectives	To apply modeling and simulation paradigms and methodologies to mechanical engineering systems. Use current commercial software such as MATLAB/SIMULINK, Excel, and SolidWorks to model and simulate a variety of mechanical engineering systems.
Course Outcomes	Students who successfully complete this course will have demonstrated an ability to:
	<ol> <li>understand and apply the modeling and simulation life-cycle process to a variety of mechanical engineering systems (1)</li> </ol>
	2. (a) develop models of mechanical engineering systems,

	(b) implement on a computer, (c) perform simulation experiment, (d) verify and validate the model <b>(1)</b>
	3. use modeling and simulation in the design process (2)
	<ol> <li>incorporate (a) uncertainty, (b) cost, and (c) optimization in a modeling and simulation study (1)</li> </ol>
	<ol> <li>effectively communicate the results of a modeling and simulation study (3)</li> </ol>
Lecture Topics	<ol> <li>Introduction to modeling and simulation</li> <li>Different types of models</li> </ol>
	<ul> <li>(a) Discrete vs continuous systems</li> <li>(b) Linear vs non-linear systems</li> <li>(c) Deterministic vs stochastic systems</li> <li>(d) Static vs dynamic systems</li> <li>(e) Steady vs transient systems</li> </ul>
	<ol> <li>Computer implementation &amp; numerical solution</li> <li>Verification and validation</li> </ol>
	5. Design decision models
	6. Sustainable engineering and life-cycle analysis
	7. Value, cost, and demand models
	8. Design of simulation experiments
	9. Goal seeking and optimization
	11. Stability and what-if analysis
Computer Usage	High
Laboratory Experience	None
Design Experience	Medium

Coordinator Donald Mueller, Ph.D., P.E.

 Date
 17 October 2022