**Department of Mechanical Engineering Technology**

*Course number/name:*

MECH 3550 Simulation and Visualization

*Credits/contact hours:*

3 credits, 2 class hours, and 2 lab hour

*Instructor/coordinator:*

Sidi Berri, Professor of Mechanical Engineering Technology

*Text book/title/author/year*

Simulation Modeling and Analysis with Expertfit Software, 4th Edition Averill Law, Averill M. Law & Associates,McGraw Hill ©2007, ISBN-13 9780073294414

*Specific course information*

*Catalog description:*

This course introduces to students a) all important aspects of a simulation study, b) how to use computer tools to visualize the simulation model. It covers the art and science of simulation and visualization in general. Topics include simulation basics, planning, data collection and analysis, model building, model verification and validation, output analysis and experimental design, visualization technique. At the end of such a course, the students will be prepared to carry out complete and effective simulation studies and to visualization model.

*Pre/Corequisites:*

MAT1475

*Required/elective/selected elective:*

Elective for Mechanical Engineering Technology and Industrial Design Technology

*Course learning objectives:*

1. Understand and build basic simulation models. Demonstrate comprehension of the basic mathematical methods in building the simulation models.
2. Model complex systems and use simulation software. Display competency in create complex system models using various mathematical techniques.
3. Perform model verification and validation. Illustrate skills in using visualization tools to verify design intent.
4. Perform simulation output analysis and optimization. Demonstrate skills in refining simulation models to achieve desired outcome.
5. Perform simulation of manufacturing systems. Display competency and skills in creating a model to simulate the process of manufacturing a product.
6. Create simulation and visualization models to solve problems in dynamics and vibrations. Develop skills in generating models using simulation and visualization software and perform analysis on these models.
7. Develop simulation and visualization models to solve problems related to fluid powers. Demonstrate ability in using various advanced simulation and visualization features to model systems in fluid mechanics.
8. Create simulation and visualization models in motion control systems. Demonstrate skills in various mathematical tools in simulation and visualization related to systems control.

*Course addresses ABET student outcomes:* SO1, SO2 and SO3

*Brief list of topics to be covered:*

- Overview of Simulation and Visualization. Basic simulation modeling, system dynamics, discrete-event simulation, data collection and analysis. Relationship among systems, models, and simulation. Laboratory work: Overview of Simulation and Visualization software. Familiarize with Promodel, or Expertfit, and Matlab or other programming software.

- Build Simple Simulation Models. Modeling simple manufacturing systems, modeling service systems, model verification and validation, basic modeling concepts. Random-number generators, Probability Distributions. Laboratory work: Hands-on Practice on ProModel 6.0 or Expertfit. Running sample simulation models using the software provided.

- Modeling Complex Systems. Building valid, credible, and appropriate detailed simulation models; output data analysis; comparing alternative system configurations; Model verification and validation; Laboratory work: Simulation Project I. Creating simulation models to meet various design criteria.

- Simulation of Manufacturing Systems. Characteristics of manufacturing systems Simulation optimization, experimental design, sensitivity analysis. Laboratory work: Simulation Project I (continued).

- Creation of a Vibration Model. Single-degree-of freedom systems, multi-degree-of freedom systems, vibration of thin beams. Laboratory work: Creation of a Model to Simulate and Visualize Vibration. Use of simulation and visualization software to create the model.

- Fluid Mechanics Simulation. Hydrostatics, internal viscous flow, external flow, open channel flow. Laboratory work: Creation of a Model to Simulate and Visualize a Fluid Mechanics System. Use of simulation and visualization software to create the model.

- Simulation of a Control System. Representation of systems in Matlab, response of systems, design tools, design examples. Laboratory work: Creation of a Control System. Using tools in Matlab to create a model to simulation a control system.