

## Course Syllabus

- 1) **Course title:** Introduction to Modeling and Simulation for Test & Evaluation
- 2) **Course coordinator & point of contact:** Dr. Mikel D. Petty, UAHuntsville, Center for Modeling, Simulation & Analysis, 256-824-4368, pettym@uah.edu
- 3) **Course description:** This course addresses the use of modeling and simulation as a complement to physical testing in support of systems evaluation. The general relationships among modeling, simulation, test, and evaluation are introduced in context of systems acquisition life-cycle management. Forms of use of simulation in support of test planning, test execution, and systems analysis will be described, characterized, and illustrated with real-world examples. Issues and opportunities relevant to the integrated use of simulation and testing will be identified; and strategies to optimize the use of scarce resources in executing test and evaluation programs will be provided.
- 4) **Course learning objectives:**
  - a) Identify and apply DoD policies and regulations related to M&S for T&E [ESR T1]
  - b) Identify types of M&S, uses and benefits, and limitations and risks for T&E [ESR T1, ESR T2]
  - c) Identify the uses of M&S during Developmental T&E (DT&E), Operational T&E (OT&E), and Live Fire T&E [ESR T3]
  - d) Identify the uses of M&S for testing in a joint environment [ESR T3]
  - e) Describe the process and importance of M&S Validation, Verification, & Accreditation [ESR T2]
  - f) Describe the M&S program contractual process [ESR T4]
  - g) Match existing M&S T&E facilities used within the DoD to a given program need, as appropriate [ESR T5]
- 5) **Educational Skill Requirements (ESR) and level of mastery:**
  - a) ESR T-1 General Awareness and Understanding
  - b) ESR T-2 General Awareness and Understanding
  - c) ESR T-3 General Awareness and Understanding
  - d) ESR T-4 General Awareness and Understanding
  - e) ESR T-5 General Awareness and Understanding
- 6) **Prerequisites:** Baccalaureate degree with technical exposure to Systems Analysis and Design and Systems Simulation

- 7) **Course format and delivery:** Resident class lecture for a 16 week semester with 3 hours of lecture per week
- 8) **Recommended texts:**
  1. Systems Engineering Principles and Practice, by A. Kossiakoff and W. N. Sweet, NY: Wiley, 2003
  2. Department of the Army Pamphlet 73–1: Test and Evaluation in Support of Systems Acquisition, Headquarters, Department of the Army, Washington, DC, 30 May 2003.
  3. National Research Council, Modeling and Simulation in Manufacturing and Defense Acquisition: Pathways to Success. 2002. Accessed at <http://www.nap.edu/catalog/10425.html>
  4. Principles of Modeling and Simulation, by J.A. Sokolowski & C. M. Banks, NY: Wiley, 2009.
- 9) **Course assessments:** Three exams, course exercises and case studies
- 10) **Suggested Schedule of Lecture Topics, Exercises & Exams by Class Meeting**
  - 1) Course Introduction and Overview
  - 2) The Scientific Method
  - 3) Logic of Hypothesis Testing
  - 4) Exercise 1 Hypotheses and Arguments
  - 5) Risk Assessment
  - 6) Scientific Propositions and Policy
  - 7) Exercises 2 & 3 Risk, Monte Carlo Models & Policy
  - 8) DoD Acquisition Framework and Systems
  - 9) Acquisitions
  - 10) System Capability
  - 11) Systems Engineering
  - 12) Design Parameters
  - 13) Exercise 4 “Built for the People”: Complexities of System Acquisition
  - 14) Testing and Evaluating
  - 15) Data Analysis
  - 16) Exercise 5 Building, Testing & Simulating a Pendulum Clock
  - 17) Exercise 6 Big Dog Case Study

- 18) Exam 1
- 19) Introduction to Modeling and Simulation
- 20) Live, Virtual and Constructive Simulation
- 21) Exercise 7 Simulating a Bank Teller
- 22) Verification, Validation and Accreditation
- 23) Exercise 8 Server Utility Simulation
- 24) Design of Experiments
- 25) Factorial Designs
- 26) Instruments and Metrics
- 27) Correlation, Simple Experiments & Inference
- 28) Data Integration
- 29) Exercise 9 Two Group & Factorial Analysis
- 30) Exam 2
- 31) Modeling & Simulation for T&E
- 32) Planning M&S for Developmental & Operational Testing
- 33) Testing and Simulation Facilities
- 34) T&E and M&S in System Integration
- 35) Exercise 10 Operationally Testing a Pendulum Clock
- 36) Rapid Acquisition & Late Phase Testing
- 37) Ethics, Safety and Deficiency Analysis
- 38) Exercise 11 Air Traffic Control Radar Case Study
- 39) Planning and Executing M&S for T&E
- 40) M&S and Test Documentation
- 41) M&S and Program Contracts
- 42) Test Execution and Scenarios
- 43) Design of Test for Execution
- 44) Exercise 12 Planning T&E and M&S: Material Analysis Solution
- 45) Exam 3