Modeling & Simulation specification

Course Specifications

Program(s) on which the course is given: Bachelor in Computer and Information Sciences

Major or Minor element of programs **:** Computer Science, Scientific Computing

Department offering the program **:** Scientific Computing

Department responsible for course **:** Scientific Computing

Academic year / Level **:** 4th Year/BSc

Date of specification approval **:** 15/10/2009

A. Basic Information

Title: Modeling & Simulation **Code:** SCC 430

Lecture: 3 hrs/week **Practical:** 2 hrs/week **Tutorial:** ---

Credit Hours: --- **Total:** 5 hrs/week

B. Professional Information

1. Overall Aims of Course:

The aim of the course is to have students understand the general theoretical concepts of computer modeling and simulation applied to discrete simulation for decision support. The course will also provide students with thorough understanding of the sequence of activities related to computer simulation (problem statement, data acquisition, model design, simulation experiment, verification,

validation, documentation), appreciate the application of simulation

techniques and methods in different industrial and research applications. Additionally, the course introduces mathematical and statistical models, simulation languages.

2. Intended Learning Outcomes of Course (ILOs):

a. Knowledge and Understanding:

a1- Explain basic paradigms in system modeling.
a2- Recognize different simulation concepts and tools.
a3- Explain concepts of verification and validation.
a4- Apply simple queuing theory to estimate discrete system behavior.
a5- Illustrate mathematical derivation of models and link this understanding to simulation results and real systems.
a6- Understand limitations of models and simulations compared to actual physical system and closed form analytical techniques.
a7- Explain input, output, and operating variables as appropriate in various units
a8- Understand how to validate a simulation against a real system
a9- Understand the essential mathematics relevant to computer science.

b. Intellectual Skills:

b1- Conclude discrete simulation programs utilizing event and process oriented approach with a time scheduling mechanism.
b2- Analyze statistical data and generate random numbers of a required distribution and parameters.
b3- Estimate data inputs and outputs needed for adequate definition of a model and to compare a simulation to real system.
b4- Use modeling and simulation techniques to identify technical relationships between the inputs, output and variables and using the relationships to predict mutual changes.

b5- Define traditional and nontraditional problems, set goals towards solving them, and. observe results.

b6- Perform comparisons between (algorithms, methods, techniques...etc).

b7- Create and/or justify designs to satisfy given requirements (synthesis, evaluation, application).

b8- Interpret ways in which mathematics is being applied in motion dynamics.

b9- Distinguish the different types of algorithm paradigms and evaluate when an algorithmic design situation calls for it.

b10- Criticize performance and analyze suitable usage cases.

c. Professional and Practical Skills:

c1- Establish system simulations and models appropriate to efficient scientific practices.

c2- Communicate effectively by oral, written and visual means.

c3- Perform independent information acquisition and management, using the scientific literature.

c4- Specify, design, and implement computer-based systems.

c5- Apply the principles of human-computer interaction to the evaluation and construction of a wide range of materials.

d. General and Transferable Skills:

d1- Present simulation and modeling tools to assist in finding graphical, numerical, statistical and analytic solutions to practical problems.

d2- Work in stressful environment and within constraints.

d3- Manage tasks and resources.

d4- Search for information and adopt life-long self-learning.

d5- Apply improved problem solving skills to basic real world situations.

d6- Present a timeline for the project plan.

d7- Discuss the problem and how to deal with it as a data to be processed.

e. Attitude:

e1- A knowledge and respect of ethics and ethical standards in relation to a major area of study.

e2- Demonstrate an ethical behavior toward software copyrights

e3- Relationship Emphasis a successful with other students.

Contents:

Topic	No. of hours	Lecture	Tutorial/ Practical
Basic simulation modeling. Nature of simulation. System models & simulation.-I	5	3	2
Introduction to Matlab/Simulink for modeling and simulation.-I	5	3	2
Mathematical modeling of differential equations using Matlab/Simulink.-I	5	3	2
Mathematical modeling of physical control system.-I	5	3	2
Mathematical modeling of electrical components and circuits.-I	5	3	2
Building valid and credible simulation models. Principles of valid simulation modeling.-I	5	3	2
Verification of simulation computer programs. An approach for developing valid & credible simulation models.-I	5	3	2
Mathematical modeling of mechanical elements.-I	5	3	2
Mathematical modeling of electrical machines.-I	5	3	2
Mathematical modeling of power electronic devices and circuits.-I	5	3	2
Mathematical modeling of physical drive systems and others.-I	5	3	2
Mathematical modeling of physical drive systems and others.-II	5	3	2