## Academic Year
2010-2011

## Module Code
CS7058

## Module Title
Numerical Methods & Advanced Mathematical Modelling - II

## Pre-requisites
BA/BSc/BEng (or equivalent) that includes mathematics and statistics
In general, students must have taken Numerical Methods & Advanced Mathematical Modelling 1

## ECTS
5

## Chief Examiner
Dr. Mícheál Mac an Airchinnigh

## Teaching Staff
Dr. Mícheál Mac an Airchinnigh

## Delivery
2 lectures and 1 tutorial per week; attendance is obligatory

## Aims
Encourage and foster the development of independent critical thinking. In particular students should be able to:
- model problems using mathematics and statistics,
- formulate and propose solutions,
- infer from observation and interpret results.
The students should be able to use, critique, and edit (where relevant) Internet resources such as Wikipedia, Wolfram Research, ...

## Learning Outcomes
Students will be able to model and solve problems using three distinct, yet complementary, approaches: analytical, numerical and observational. They will also be able to use and construct mathematical programs using computational resources such as Mathematica, MATLAB, ...

## Syllabus
Specific themes addressed within the module will be drawn from the list:
- Analytics
  - Partial Differential Equations
  - Variational Principles
  - Random Systems 2, Stochastic processes
- Numerics
  - Partial Differential Equations, Finite Differences, Finite Elements
  - Cellular Automata 2, practical applications (e.g. in physics, music)
- Observations
  - Transforms: Fourier transform, Wavelets
  - Optimization and Search: Genetic Algorithms
  - Clustering - Cluster Analysis
  - Filtering and State Estimation:
    - Wiener Filter, Kalman Filter
  - Time Series 2, state-space reconstruction

## Assessment
Project / Assignment – 20%
Examination – 80%

## Bibliography
Main Course Text:

Each student will choose those texts from the Trinity College Library that address and expand upon her/his own particular Mathematical interests within the analytical, numerical and observational framework. In addition each student will avail of appropriate scholarly Internet resources such as Wolfram’s “A New Kind of Science.” Students are expected to be able to access papers in the research journals appropriate to their own speciality within the degree program.

## Website
http://isg.cs.tcd.ie/IET/