Numerical Computing Methods Course Specifications

Faculty: Computer and Informatics

Department: Scientific Computing

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

Major or Minor element of programs	**:**	All majors
Department offering the program	**:**	Scientific Computing
Department offering the course	**:**	Scientific Computing
Academic year / Level	**:**	3rd year / B.Sc.
Date of specification approval	**:**	3/10/2009

A. Basic Information

Title: Numerical Computing Methods **Code:** SCC 332

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

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

B. Professional Information

1. Overall Aims of Course:

The main goal of this course is to provide students with an introduction to the field of numerical analysis. Aside from developing competency in numerical analysis topics, the course aims to: further develop and apply problem solving skills through the introduction of

numerical methods; provide a ground for applying knowledge acquired in previous mathematics courses.

2. Intended Learning Outcomes of Course (ILOs):

a. Knowledge and Understanding

a1- Understand the advantages and disadvantages of alternative standard numerical algorithms.

a2- Recognize the importance of error estimates and be able to make simple estimates of truncation errors.

a3- Understand basic matrix and vector operations, numerical differentiation and integration

a4- Understanding which method is applicable to solve systems of linear equations and the nature of the information provided by each.

a5- Describe difficulties that can arise because computers usually use finite precision, often non-decimal arithmetic.

a6- Give an account on sources of error in computation, particularly to be able to identify when catastrophic cancellation may occur in a given computation.

b. Intellectual Skills:

b1- Analyze a practical problem, understand the mathematical basis of the problem,

b2- Develop and implement an algorithm to find a numerical solution of the problem.

b3- Study the solution and develop a practical interpretation of the numerical results.

b4- Solve ordinary and partial differential equations using numerical techniques

b5- State the definition of the order of convergence of an iterative method, and describe how the order of a method relates to both the convergence and error behavior

for that method. Describe the order of convergence of standard iterative methods.

c. Professional and Practical Skills:

c1- Use of standard numerical techniques in solving practical scientific problems

c2- Apply basic numerical techniques to the solution of mathematical problems.

d. General and Transferable Skills:

d1- Manage time effectively.

d2- Apply numerical analysis for practical problems in different settings.

d3- Present knowledge of various numerical methods in different applications.

e. Attitude:

e1- Relationship Emphasis a successful with other students.

e2- Learn how to make relation with other, and the limit of this relation.

3. Contents:

Topic	No. of hours	Lecture	Tutorial
Computational errors. Floating-point computation. Root finding: Bisection method, Fixed Pint methods, Netown's method, and secant method , convergence and Error Analysis for Iterative Methods - I	5	3	2
Computational errors. Floating-point computation. Root finding: Bisection method, Fixed Pint methods, Netown's method, and secant method , convergence and Error Analysis for Iterative Methods - II	5	3	2
Computational errors. Floating-point computation. Root finding: Bisection method, Fixed Pint methods, Netown's method, and secant method , convergence and	5	3	2

Error Analysis for Iterative Methods - III			
Approximation theory: Polynomial approximation, interpolation, extrapolation – I	5	3	2
Approximation theory: Polynomial approximation, interpolation, extrapolation – II	5	3	2
Approximation theory: Polynomial approximation, interpolation, extrapolation – III	5	3	2
Numerical differentiation and integration – I	5	3	2
Numerical differentiation and integration – II	5	3	2
Numerical differentiation and integration – III	5	3	2
Initial value problems for ODE: Picard's method, Euler's method, Taylor-series methods, and Rung-Kutta methods, – I	5	3	2
Initial value problems for ODE: Picard's method, Euler's method, Taylor-series methods, and Rung-Kutta methods, – II	5	3	2
Initial value problems for ODE: Picard's method, Euler's method, Taylor-series methods, and Rung-Kutta methods, – III	5	3	2
Numerical solutions of linear systems of equations,– I	5	3	2
Numerical solutions of linear systems of equations,– II	5	3	2