Philadelphia University
Department of Basic Sciences and Mathematics

First Semester **Course Syllabus** **2011/2012**

Course Title	Numerical Analysis
Course Code	250371
Lecturer	
Office Room	
Office Hours	
E−mail	
Webpage	

Course Description

This module is a first course in Numerical Analysis covering topics such as finding roots of polynomials, interpolation and polynomial approximation, numerical differentiation and integration, numerical solutions of ordinary differential equations, and selected topics in numerical methods of linear algebra.

Topics by the Week

Week	Topics
1	**Mathematical Preliminaries:** Roundoff Errors and Computer Arithmetic. **Solutions of Equations in One Variables:** The Bisection Method.
2	Fixed−Point Iteration, Newton's Method.
3	**Interpolating and Polynomial Approximation:** Interpolating and Lagrange Polynomial, Divided Differences.
4	Hermite Interpolating, Cubic Spline Interpolation.
5	**Al−Adha Feast**
6	**Numerical Differentiation and Integration:** Numerical Differentiation, Richardson's Extrapolation
7	Elements of Numerical Integration, Composite Numerical Integration
8	Romberg Integration, Gaussian Quadrature.
9	**Initial−Value Problems for Ordinary Differential Equations:** The Elementary Theory of Initial−Value Problems, Euler's Method.
10	Higher−Order Taylor Methods, Runge−Kutta Methods, Error Control and the Runge−Kutta−Fehlberg Method
11	Multistep Methods, Variable Step−Size Multistep Methods.
12	**Direct Methods for Solving Linear Systems:** Linear Systems of Equations, Pivoting Strategies, Linear Algebra and Matrix Inversion
13	The Determinant of a Matrix, Matrix Factorization.
14	**Iterative Techniques in Matrix Algebra:** Norms of Vectors and Matrices, Eigenvalues and Eigenvectors.
15	Iterative Techniques for Solving Linear Systems, Error Bounds and Iterative Refinement.
16	**Final Exams**

Course Objectives Upon completion of the course, the student will be able to:

- To present most of the available numerical methods for solving problems with concentration on a sufficient number of methods to handle the problems likely to be encountered in practice.
- To introduce students to the potentialities of modern computer for solving problems in science and technology.
- To develop the students skills in computer programming by carrying out a variety of programming exercises.
- To present a wide diversity of topics so that the student can see at once the immense range of applications of the subject.

Learning Outcomes The student will have the knowledge and understanding of how to:

- Find roots of functions using different methods.
- Approximate functions by different kinds of polynomials.
- Solve different types of linear systems using direct methods.
- Solve linear systems with Iterative Techniques.
- Approximate discrete data with different kinds of polynomials.

Assessment Distribution

Students will be assessed based on a 100 total marks, which are distributed as follows.

Exam Type	**Expected Time**	**Points Allocated**
First		20%
Second		20%
Homeworks, Projects, Quizzes		20%
Final		40%

Textbook and Supporting Materials

– Richard L. Johnson and Douglas J. Faires, **Numerical Analysis, 7th Edition**, Brooks/ Cole 2001. Call number in PU library: 519.4 BUR.

– John H. Mathews and Kurtis D. Fink, **Numerical methods using MATLAB, 4th Edition**, Prentice Hall 2004. Call number in PU library: 519.402855369 MAT.

– Ward Cheney and David Kincaid, **Numerical mathematics and computing, 5th Edition**, Brooks/ Cole 2004. Call number in PU library: 519.40285 CHE.

Class Attendance

Attendance is expected of every student. Being absent is not an excuse for not knowing

about any important information that may have been given in class. Under the University's regulations, a student whose absence record exceeds 15% of total class hours will automatically fail the course. Students who in any way disrupt the class will be expelled from the classroom and will not be allowed to return until the problem has been resolved.

Project Assignments

Students are allowed to work together on a project assignment; however, the work that is turned in by each student must be his own. For instance, a mere copy of another student's work will not be graded. A written project must be properly presented to receive full credit. A late project is penalized one point per day after its due date. A project sent by email will not be accepted.

Late Exams

Late (make-up) exams will be given only to students who have a valid excuse and are able to provide a written document for its verification. The level of difficulty of a late exam is about 50% higher than that of the corresponding regular exam. All late exams will be conducted during the last week of the semester. Each student is allowed only one make-up in a semester, either for the first exam or the second, but not both. There is no make-up for a late exam.

Dishonesty

Any form of dishonest conduct will be strictly punished. A student who is caught cheating, or attempting to do so in an exam will be given a zero for the exam and a report will be written to the Dean for further action. A student who helps another student or is seen communicating with another student in an exam will be given the same penalty stated in the previous point. Students with different exam forms are not exempt from the above rules. Repeat offenders will be expelled permanently and banned from future courses.