Course specifications

Programme(s) on which the course is given	Pre-Master, PureMathematics
Major or minor element of programs	Major
Department offering the program	Mathematics
Department offering the course	Mathematics
Academic year / Level	**Post – graduate studies**
Date of specification	

A- Basic Information

Title: Numerical Analysis Code: M6118

Credit Hours: 2 hrs Lecture: 2 hrs
Tutorial: 0 Practical:0 Total: 2 hrs

Teaching Staff: Dr. Naglaa El-Shazly

B- Professional Information

1 – Overall aims of course

The course is the basic course in numerical methods, introduces students to: know some special matrices (Hessenberg – Permutation – Normalized – idempotent and Nonderogatory matrices). Introduce and know some basic results on eigenvalues and eigenvectors (Schur's triangularization theores and its applications – diagonalization of Hermitian matrices). Some useful transformations in numerical linear algebra and their applications, know and apply LU Factorization, Householder transformation, QR factorization and Givens rotation. Solve linear systems using Orthogonal factorization methods and Cholesky factorization for symmetric positive definite matrices. Know and analyze the perturbation of the linear system. Learn numerical solutions to ordinary differential equations Numerical differentiation and integration. Introduce and apply Stirling's and Bessel's formulas, Maxima & Minima of tabulated function and Romberg's rules. Define and apply Kronecker product, Vec-operator and Moore –Penrose inverse.

2 – Intended Learning Outcomes of Course (ILOs)

a- Knowledge and Understanding:

a1- Know some special matrices and basic results on eigenvalues and eigenvectors

a2- Understand some useful transformations in numerical linear algebra and their applications

a3- Know and analyze the perturbation of the linear system

a4- Learn the basic methods for solving ordinary differential equations.

a5- Define and apply Kronecker product, Vec-operator and Moore – Penrose inverse.

b- Intellectual Skills

b1 Analyze and compare the different techniques for solving linear systems

b2 Analyze and compare the different techniques for solving ordinary differential equations

c- Professional and practical skills

The student should be able to;

c1- Set a program of exercise based on the tools he learned in the course.

c2-Weight the outcomes of the course through its use in practical application in different scientific fields.

d- General and transferable skills

The student should be able to;

d1- Discuss and work in a group in order to solve numerical approximation problems.

d2- Discuss and work in a group in order to program numerical solutions using Matlab

d3- Demonstrate developed solutions and programs

d4- Deal with computational problems related to the topics covered in the course

d5-Provide an extend and modification of the methods of the course for more complicated problems in computational mathematics.

3- Contents

Topic	No. of hours	Lecture
Some special matrices: Hessenberg – Permutation – Normalized – Companion – Nonderogatory and idempotent matrices. Some basic results on eigenvalues and eigenvectors (Schur's triangularization theores and its applications – diagonalization of Hermitian matrices) – Norms of vectors and matrices (properties and	10	5
Some useful transformations in numerical linear algebra: LU Factorization, Householder transformation, QR factorization and Givens rotation. Solve linear systems using Orthogonal factorization methods and Cholesky factorization for symmetric positive definite matrices – Types of errors – Condition number – accuracy of solution of	8	4
Numerical differentiation and integration: Stirling's formula – Bessel's formula – Maxima & Minima of tabulated function and Romberg's rules. Kronecker product, Vec-operator and Moore – Penrose inverse. Relationships between roots and coefficients of the polynomial equation in x of n^{th} degree	10	5

4– Teaching and learning methods

4.1- Lectures
4.2- Working on hand in assignments
4.3- Attending practical classes

5- Student assessment methods

5.1 Mid term written exam to assess understanding competencies
5.2 Oral Exam to assess attendance and interesting.
5.3 Semester hand in assignments to assess understanding professionalism.
5.4 Final term written Exam to assess comprehension.

Assessment schedule

Assessment 1 Mid term Week 4 and 7

Assessment 2	semester activities	Week 5 and 8
Assessment 3	Final term oral exam	Week 13
Assessment 4	final term written exam	Week 14

Weighting of assessments

Mid-Term Examination	20%
Semester Work (homework assignments + oral tests)	20 %
Final-term written Examination	60%
Total	100%

Any formative only assessments

6- List of references

6.1- Course notes

Collected and prepared notes that cover the main topics in the course content

6.2- Essential books (text books)

6.3- Recommended books

6.4- Periodicals, Web sites, … etc

Non.

7- Facilities required for teaching and learning

PC's - packages for ready made scientific programs.

Course coordinator: Dr. Naglaa El-Shazly

Head of Department: Prof. Dr. Mohamed Abel-Latif Ramadan

Date: / /