# SYLLABUS

| *Course Code* | *Course Num.* | *Course Name* | *Credit Hours* | *Lec.* | *Lab.* | *Tut.* | *Private study* | *Pre-requisites* | *Course Level* | *Teaching Language* |
|---|---|---|---|---|---|---|---|---|---|---|
| **MAT** | **641** | Numerical Analysis | **4** | **3** | **0** | **1** | **9** | | **1**[1] | **English** |

[1] *Level 2 for the B.Sc. in Applied Mathematics and Chemistry, and Level 3 for Physics*

## A. Course Description

This course describes the most important ideas in numerical analysis: error, convergence and stability analysis for the algorithms and implement these using a Computer Algebra System (CAS) such as MATLAB. Moreover, basic numerical methods are introduced to find numerical solution of certain test problems.

## B. Course Outcomes

At the end of this course the student will be able to :

1. Find approximate solutions of some mathematical problems using numerical methods.
2. Know basic numerical methods and corresponding numerical algorithms

## C. References:

**Required Textbook**

***1. R.L. Burden, J.D. Faires, Numerical Analysis, 8th Edition. (Main Reference)***

**Other references:**

**2. J. Stoer, R. Burlish, *Introduction to numerical Analysis*; Springer-Verlag, 3rd Ed. 2010.**

**3. T. Sauer, *Numerical Analysis*, Pearson 2012.**

**Course Website:** Google Classroom Webpage:http://www.imamm.org/

## D. Topics Outline

1. **Preliminaries:** Errors and numbers representation; Floating-point representation, Significant digits, Rounding and chopping, Accuracy and Precision, absolute error and relative error, Truncation error.
2. **Solving Equations:** Bisection, fixed-point iterations, Newton's method, Brent method, Aitkin's $\Delta$ 2 method & Muller method; Error and convergence analysis.
3. **Solving Linear Systems:** Direct methods: Pivoting, LU factorization; Norms of vectors and matrices; Well-posed and ill-posed problems; Conditioning and Error analysis; Iterative methods: Jacobi, Gauss-Seidel & SOR methods; Krylov subspaces methods (Conjugate gradient method, GMRES,...); Error and convergence analysis; Preconditioning; Solving.
4. **Eigenvalue Problem:** Power and Inverse Power method, Jacobi method, Householder method, QR method, Singular value decomposition.

## E. Office Hours

Office hours give students the opportunity to ask in-depth questions and to explore points of confusion or interest that cannot be fully addressed in class.

## F. Exams & Grading System

The semi-official dates of the exams for this course are:

- **Midterm :** $8^{th}$ or $9^{th}$ week.
- **Quizzes & Homeworks:** During the semester.
- **Final Exam:** $16^{th}$ week.

Your course grade will be based on your semester work as follows:

| | |
|---|---|
| **Midterm :** 30 % | **Final Exam:** 40 % |
| **Quizzes, Homework, Attendance & Participation:** 30 % | |

The grading distribution:

| $A^+$ | A | $B^+$ | B | $C^+$ | C | F |
|---|---|---|---|---|---|---|
| [95, 100] | [90, 95) | [85, 90) | [80, 85) | [75, 80) | [70, 75) | [0, 70) |

## G. Student Attendance/Absence

Only three situations will be considered as possible excused absences:

- Occurrence of a birth or death in the immediate family will be excused. ("Immediate family" is defined by the University as spouse, grandparents, parents, brother, or sister).
- Severe illness in which a student is under the care of a doctor and physically unable to attend class will be excused. Students are not excused for a doctor's appointment. Do not make appointments that conflict with rehearsals. Notes from the University Health Center will be accepted.

**Executive Rules for Study Regulations and Examsgoo.gl/ykm7t3**

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