



## 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	8		1	English

### 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

*R.L. Burden, J.D. Faires, Numerical Analysis, 8th Edition.*

#### Other references:

1. *J. Stoer, R. Burlish, Introduction to numerical Analysis; Springer-Verlag, 3rd Ed. 2010.*
2. *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<sup>th</sup> or 9<sup>th</sup> week.
- **Quizzes & homework:** During the semester.
- **Final Exam:** 16<sup>th</sup> week.

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

<b>Midterm :</b> 30 %	<b>Final Exam:</b> 40 %
<b>4 Quizzes + 4 Homeworks, Attendance &amp; Participation:</b> 30 %	

The grading distribution:

A <sup>+</sup>	A	B <sup>+</sup>	B	C <sup>+</sup>	C	F
[95, 100]	[90, 95)	[85, 90)	[80, 85)	[75, 80)	[70, 75)	[0, 70)



## G. Student Workload:

#	Teaching/learning activities	Contact Hours	Frequency	Total Contact hours	Self-study hours	Total self-study hours	Student Learning Time
1	Lecture	3	15	45	1.5	22.5	67.5
2	Tutorial	1	15	15	3	45	60
3	Lab\Practical	0	0	0	0	0	0
4	Homework	0	4	0	1.5	22.5	22.5
5	Quiz	0.25	4	1	1	4	5
6	Test (Midterm)	2	1	2	12	12	14
7	Final Exam	2	1	2	12	12	14
Total				<b>65</b>		<b>118</b>	<b>183</b>

Independent self-study =  $118/15 \cong 8$  hrs per week

## H. 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](http://Examsgoo.gl/ykm7t3)

