Alanya Alaaddin Keykubat University | Rafet Kayış Faculty of Engineering
Mechanical Engineering Department
2021-2022 Spring Semester
SYLLABUS

Code/Name	MEC 208 / Numerical Methods
Type	Required
Credit/ECTS	4/4
Hour per Week	3 (3+0+0)
Level/Year	Undergraduate/2
Semester	Spring
Classroom	A-103
Content	Basic concepts of computational methods. Error analysis. Numerical solutions of linear and nonlinear algebraic equations. Numerical approximations: regression and interpolation. Numerical differentiation and integration. Numerical solution of ordinary differential equations: initial and boundary value problems, eigenvalue problems. Introduction to the numerical solution of partial differential equations. Applications using appropriate software.
Prerequisites	
Textbooks	***Primary*** Chapra SC, Canale RP, *Numerical Methods for Engineers*, 8th edition, McGraw-Hill, 2021. ***Supplementary*** Hoffman JD, Frankel S, *Numerical Methods for Engineers and Scientists*, 2nd edition, CRC Press, 2001.
Objectives	• To analyze the numerical methods in engineering applications and give knowledge about numerical approaches. • To analyze how numerical analyses can be applied to a wide range of problems of importance in engineering and industry.
Course Outcomes	In this course students will be able to: CO1 Develop stable and accurate solution algorithms for a given problem and perform error analysis of the found results CO2 Solution of the linear and non-linear equation and equation systems with various methods CO3 Application of various interpolation and curve fitting methods in the solution of engineering problems CO4 Application of numerical differentiation and integration methods in the solution of various engineering problems CO5 Understand engineering problems expressed by ODEs and solutions to these problems using numerical solution methods

Weekly Schedule of Topics

W	Topic
1	Introduction to numerical methods: Functions, Taylor series, numerical errors
2	Taylor series, numerical errors
3	LU Decomposition, Gauss Elimination, pivoting
4	Gauss-Seidel, Gauss-Jordan, matrix inverse
5	Eigenvalue and eigenvector problems, Power method
6	Roots of equations: Bisection method, Fixed-point iteration. Solutions of non-linear systems of equations
7	Non-linear systems of equations: Newton-Raphson and Secant Methods, False position (Regula-Falsi)
8	Curve fitting: Least-squares approximation; Interpolation - Newton's divided difference method, Lagrange
9	Numerical differentiation: Finite differences, Taylor differences

10	Numerical integration: Trapezoidal rule, Simpson 1/3 and 3/8 rules
11	Numerical solution of ordinary differential equations: Runge-Kutta methods, Euler's method
12	Numerical solution of ordinary differential equations: Runge-Kutta methods, Euler's method
13	Boundary-value equations, shooting method, finite differences method, eigenvalue problems
14	Boundary-value equations, shooting method, finite differences method, eigenvalue problems

Professional Contribution	Ability to understand, apply, and use the numerical methods and tools in engineering

Contribution to Program Outcomes*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	5	1	5	5	0	2	1	3	1	5	2
CO2	5	1	5	5	0	2	1	3	1	5	2
CO3	5	1	5	5	0	2	1	3	1	5	2
CO4	5	1	5	5	0	2	1	3	1	5	2
CO5	5	1	5	5	0	2	1	3	1	5	2
CO6	5	1	5	5	0	2	1	3	1	5	2

* Contribution Level | 0: None | 1: Very Low | 2: Low | 3: Medium | 4: High | 5: Very High

Special Conditions	• The consequence of a violation of the attendance rule is to receive a grade of DZ. • The students are required to have a calculator during the class. Otherwise, they will not be accepted to the classroom. • Neither lecture notes nor PPT slides will not be shared.
Requirements	
Evaluation	Midterm Exam 30% Quizzes 20% Assignment 10% Final Exam 40% Total 100%
Rubric	
Course Policy	1. You must attend at least 70% of the sessions including add-drop period. Otherwise, you will receive a grade of DZ. 2. Be in the class on time. 3. English should always be used to communicate with one another. 4. Mobile phone should be switched off and put away during the class. 5. Illegal copies of the textbooks and other course materials cannot be used for the classwork and exams.
Cheating & Plagiarism	• Copying or letting someone to copy your work on exams, assignments, or reports is cheating. • Cutting and pasting text, figures and tables from the web sources or any other electronic source is plagiarism. • A consequence of academic dishonesty is to receive a grade of FF for the course.

Instructor

Name/Surname	Alparslan Topcu	Email	alparslan.topcu@alanya.edu.tr
Room	D-002	Office Hours	Tuesday: 10:30 – 11:30 Thursday: 11:00 – 13:00

Prepared by Alparslan Topcu on Feb. 4, 2021