Term 201 - MATH 371

💥 **Instructor**

Aa Name	@ Email	Office	Sections	Website
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Instructor				

📜 Course Description

Floating-point arithmetic and error analysis. Solution of non-linear equations. Polynomial interpolation. Numerical integration and differentiation. Data fitting. Solution of linear algebraic systems. Initial and boundary value problems of ordinary differential equations.

🎯 Student Learning Outcomes:

After completion of the course, the students should be able to:

- Use Taylor Series to approximate functions, evaluate the approximation errors and estimate their upper bounds.
- Understand and program algorithms to locate the approximate roots of equations.
- Understand and program algorithms to numerically solve linear systems of equations.
- Learn how to smooth collected engineering data using the least squares method.
- Use polynomials to interpolate collected precise (Note: Interpolation applies to precise data while the least-squares method applies to data exhibiting a significant degree of error or scatter.) engineering data or approximate function.
- Understand and program algorithms to evaluate the derivative or the integral of a given function, evaluate the approximation error involved and estimate its upper bound.
- Understand and program algorithms to solve engineering ordinary differential equations (ODEs) or partial differential equations (PDEs).
- Understand relationships among methods, algorithms, and computer errors.
- Apply numerical and computer programming tools to solve common engineering problems.

📚 Textbook and References

Name	Author	Publisher	Edition	Year
TextBook: Applied Numerical Methods with MATLAB	Stephen C. Chapra	McGraw-Hill	4th	2018
Ref: Numerical Methods For Engineers	Steven Chapra & Raymond Canale	McGraw-Hill	6th	2016
Ref: Numerical Analysis	Richard L. Burden, J. Douglas Faires	Cengage Learning	10th	2016

🗓️ Course Schedule

Week	Date	Sections	Section Title	Notes

Aa Week	Date	Sections	Section Title	Notes
0	@Aug 23, 2020 → Aug 27, 2020	2.1-2.5 and 3.1-3.5	2.1 The MATLAB Environment 2.2 Assignment 2.3 Mathematical Operations 2.4 Use of Built-In Functions 2.5 Graphics 3.1 M-Files 3.2 Input-Output 3.3 Structured Programming 3.4 Nesting and Indentation 3.5 Passing Functions to M-Files	
1	@Aug 30, 2020 → Sep 3, 2020	4.3 (21.2 tables),	Taylor Series, MATLAB or Julia	Centered, Forward, and Backward Difference for f'(x). Centered difference for f''(x)
2	@Sep 6, 2020 → Sep 10, 2020	22.1, 22.2	22.1 Overview 22.2 Euler's Method	
3	@Sep 13, 2020 → Sep 17, 2020	22.4, 22.5,	22.4 Runge-Kutta Methods 22.5 Systems of Equations	
4	@Sep 20, 2020 → Sep 24, 2020	18.2 (intro), 18.4,	18.2 Linear Splines(intro) 18.4 Cubic Splines	23-24 Sep (wed-Thu) National Day Holidays
5	@Sep 27, 2020 → Oct 1, 2020	9.2, 9.3,	9.2 Naive Gauss Elimination, 9.3 Pivoting,	
6	@Oct 4, 2020 → Oct 8, 2020	9.4, 12.1,	9.4 Tridiagonal Systems, 12.1 Linear Systems: Gauss-Seidel	
7	@Oct 11, 2020 → Oct 15, 2020	14.3, 14.4, 15.1,	14.3 Linear Least-Squares Regression, 14.4 Linearization of Nonlinear Relationships, 15.1 Polynomial Regression,	

Aa Week	Date	Sections	Section Title	Notes
8	@Oct 18, 2020 → Oct 22, 2020	24.1, 24.3,	24.1 Introduction and Background, 24.3 Finite-Difference Methods	
9	@Oct 25, 2020 → Oct 29, 2020	4.1, 4.2, 4.4	4.1 Errors, 4.2 Roundoff Errors, 4.4 Total Numerical Error,	
10	@Nov 1, 2020 → Nov 5, 2020	(1.3 Burden), 6.1	1.3(Burden) Algorithms and Convergence, 6.1 Simple Fixed-Point Iteration,	
11	@Nov 8, 2020 → Nov 12, 2020	6.2, 6.3, 17.1	6.2 Newton-Raphson 6.3 Secant Methods, 17.1 Introduction to Interpolation,	
12	@Nov 15, 2020 → Nov 19, 2020	17.2, 17.3	17.2 Newton Interpolating Polynomial, 17.3 Lagrange Interpolating Polynomial	
13	@Nov 22, 2020 → Nov 26, 2020	19.1, 19.2,19.3	19.1 Introduction and Background, 19.2 Newton-Cotes Formulas, 19.3 The Trapezoidal Rule,	
14	@Nov 29, 2020 → Dec 3, 2020	19.4, 10.1	19.4 Simpson's Rules, 10.1 Overview of LU Factorization	
15	@Dec 6, 2020 → Dec 10, 2020	10.2	10.2 Gauss Elimination as LU Factorization	
16	@Dec 13, 2020 → Dec 14, 2020	Review		Normal Wednesday Classes Normal Thursday Class Last day of classes
17	@Dec 16, 2020 → Dec 28, 2020	Final examinations		
Untitled	@May 26, 2020 → May 26, 2020			

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🏆 Grading Policy

Breakdown

Reading Assignments (LearnSmart) (**30** points)
Homework (**45** points)
6-Quizzes (**90** points)

Midterm exam (**45**)

Final Exam (**45**)
Term Project (**45** points)
Attendance
- (**-1**) point for missing a class
- (**-0.5**) points for being late

Evaluation

A+ [270-300]
A [240-270)
B+ [225-240)
B [210-225)
C+ [195-210)
C [180-195)
D+ [165-180)
D [150-165)
F [000-150)

⛔ Plagiarism and Cheating: (Please read carefully)

This course is composed of both individual as well as group assignments and activities. It is important that your individual assignment be completed with your own efforts instead of copying it from your fellow student. KFUPM instructors follow “zero tolerance” approach regarding cheating and plagiarism. During examinations, in person or online (quizzes, major exams, lab reports) cheating or any attempt of cheating by use of illegal activities, techniques and forms of fraud will result in a grade of F in the course along with reporting the incident to the higher university administration.

For more please read Article 38 of the undergraduate bulletin.

Taking an Online Test/Quiz

📎 Taking an Online Test/Quiz

Quiz	Wednesday 9/9/2020	6:05 - 7:25 PM
Quiz	Wednesday 23/9/2020	5:45 - 7:05 PM
Quiz	Wednesday 7/10/2020	5:45 - 7:05 PM
Midterm	**Wednesday 21/10/2020**	**5:45 - 7:45 PM**
Quiz	Wednesday 4/11/2020	5:45 - 7:05 PM

Quiz	Wednesday 18/11/2020	5:45 - 7:05 PM
Quiz	Wednesday 2/12/2020	5:45 - 7:05 PM

📋 Term Project

- Proposal (6 points)
  once you are ready submit your proposal
- Progress report (4 points)
- Product (27 points)
  - Website:
    - Introduction
    - Mathematical model(s).
    - Method (formulas); math background; data source
    - Numerical Results and visualization and discussion
    - Summary
- Presentation (8 points)