

## **Syllabus**

**Course Number: MT 405**

**Course Title: Numerical Methods**

### **Course Description:**

Uses computers in solving linear and nonlinear equations, approximation theory, numerical integration and differentiation, numerical solution of differential equations and linear programming.

### **Prerequisite Courses:**

MT360B – Calculus II

### **Course Overview**

*(Syllabus Author: Insert the course overview here. Remove this note when complete.)*

Key concepts to be covered in this course include:

- 
- 

### **Course Outcomes:**

Upon completion of this course, learners should be able to:

1. Distinguish the fundamental difference between a derivative and an integral.
2. Use the difference quotient and how it relates to the concept of a limit.
3. Understand the convergence and what it tells us about a function.
4. Ask what are the issues behind error analysis, and do some functions produce more error than another?
5. Define a function.
6. Determine what constitutes a system of functions.
7. See if a function belongs to a system, and whether or not a function takes on characteristics of the system
8. Derive a nonlinear function or a system of functions.
9. Use the study of algebra.
10. See what it means to study those objects Linearly.
11. Distinguish which method discussed in class is the better, which would converge faster, use less memory.
12. Know what an infinite and finite series is.

13. In iterative solutions, can also have recursive, which would be more useful.
14. See why these methods are only approximations.
15. What is the function and behavior of a polynomial?
16. Find out what characteristics of a polynomial would lead you to believe it is error prone
17. Which methods discussed work best in a computing environment?
18. Review a discussion on Differentiation.
19. Know what the application behind taking a derivative is.
20. See graphically what does a derivative look like.
21. What is an integral?
22. Recall the various methods used in Calculus to take an integral.
23. How do these methods replace integration by parts, Green's Theorem, etc...?
24. Know the difference between a derivative and a differential equation.
25. See functionally what constitutes the difference.
26. What is the difference between Ordinary and Partial Differential equations?
27. Notice how the Taylor series used in approximation of functions is used again to approximate ODE and PDE.
28. Remember what the meaning of the word Eigen is.
29. Again compare methods and benefits of each.
30. See the application behind an eigenvalue and vector.
31. Homogeneous vs. Non-homogeneous

### **Course Materials:**

*(Syllabus Author: please use APA format and include ISBN numbers)*

### **Required Texts:**

Mathews, John H., & Kurtis D. Fink. (2004). *Numerical methods using MatLab*. (4th edition). Hoboken, NJ: Prentice-Hall. ISBN10: 0-13-065248-2.

### **First Class Assignment:**

Review basic matrix operations.

1. Review definitions of derivative and integral.
2. Read the Appendix: An Introduction to Matlab, then visit the Regis lab and familiarize yourself with Matlab.
3. Write a one-page, double-spaced, computer-generated discussion of "Errors in Computer input and output." The paper should discuss the ramifications of such error, how they affect your life and if you have ever been affected. Turn this paper in to your Facilitator during the first class session.

## Course Assignments and Activities:

	Topics	Readings	Activities & Assignments	Course Outcomes Addressed
1	Course Expectations, Assignments, and Introduction	Chapter 1: Sections 1 to 3	First Night Assignment <b>Solve the following problems:</b> Section 1.1: 1, 4, 7, 11 and 16 Section 1.2: 2, 5, 8, 10, 12 and 17 Section 1.3: 1, 2, 5, 9 and 13	1-4
2	Solutions of Nonlinear Equations	Chapter 2: Sections 1 to 4	<b>Solve the following problems:</b> Section 2.1: 2, 3, 7, 9, 10 and 11 Section 2.2: 1, 4, 7, 10, 12 and 15 Section 2.3: 1, 3 and 5 Section 2.4: 2, 5, 11, 21, 22 and 23	5-8
3	Solution of a Linear System	Chapter 3: Sections 1 to 6	<b>Solve the following problems:</b> Section 3.1: 1, 2, 4 and 5 Section 3.2: 3, 5, 8, 12 and 15 Section 3.3: 1 and 6 Section 3.4: 2, 9, 13 and 15 Section 3.5: 3, 5 and 10 Section 3.6: 1, 6 and 9	9-11
4	Interpolation and Polynomial Approximation	Chapter 4: Sections 1 to 5	<b>Solve the following problems:</b> Section 4.1: 1, 3, 5, 11, 13 and 18 Section 4.2: 1, 2 and 3 Section 4.3: 1, 4, 5, 7, 10, 11 and 12 Section 4.4: 2, 5, 8, 9 and 11 Section 4.5: 1, 6, 7, 9, 10, 12 and 15	12-17
5	Numerical Differentiation	Chapter 6: Sections 1 & 2 Chapter 7: Sections 1 & 2	<b>Solve the following problems:</b> Section 6.1: 2, 6, 7, 11 and 14 Section 6.2: 1, 3, 6, 8, 12 and 14	18-20
6	Numerical Integration	Chapter 7: Sections 3 to 5	<b>Solve the following problems:</b> Section 7.3: 1 to 11 Section 7.4: 1, 2, 3 and 4 Section 7.5: 1 to 12	21-23
7	Solutions of Differential Equations	Chapter 9: Sections 1 to 4, 8 and 9	<b>Solve the following problems:</b> Section 9.1: 1 to 9, 11, 14 and 17 Section 9.2: 1 to 6 and 9 Section 9.3: 1 to 5 and 7 Section 9.4: 1 to 7 Section 9.8: 1 to 3 Section 9.9: 1 to 5	24-27
8	Eigenvalues and Eigenvectors	Chapter 11: Sections 1 to 3	<b>Solve the following problems:</b> Section 11.1: 1, 2, 3, 5, 7, 11, 12 and 13 Section 11.2: 1 to 5 Section 11.3: 1 to 3	28-31

## Student Evaluation Grid:

(Should not be part of template, but included in many syllabi)

Assignments	Weighted Percentage
First Class Assignment	5%
Homework	30%
Mid-Term Test	30%
Final Test	30%
Participation	5%
<b>TOTAL</b>	<b>100%</b>

## CC&IS Grading Scale

Letter Grade	Percentage	Grade Point
A	93 to 100	4.00
A-	90 to less than 93	3.67
B+	87 to less than 90	3.33
B	83 to less than 87	3.00
B-	80 to less than 83	2.67
C+	77 to less than 80	2.33
C	73 to less than 77	2.00
C-	70 to less than 73	1.67
D+	67 to less than 70	1.33
D	63 to less than 67	1.00
D-	60 to less than 63	.67
F	Less than 60	0

Additional information about grading can be found in the latest edition of the University Catalog, available at <http://www.regis.edu/Academics/Course%20Catalog.aspx>.

## CC&IS Policies and Procedures

Each of the following CC&IS Policies & Procedures is incorporated here by reference. Students are expected to review this information each term, and agree to the policies and procedures as identified here and specified in the latest edition of the University Catalog, available at <http://www.regis.edu/Academics/Course%20Catalog.aspx> or at the link provided.

- The CC&IS Academic Integrity Policy.

- The Student Honor Code and Student Standards of Conduct.
- Incomplete Grade Policy, Pass / No Pass Grades, Grade Reports.
- The Information Privacy policy and FERPA. For more information regarding FERPA, visit the [U.S. Department of Education](#).
- The HIPPA policies for protected health information. The complete Regis University HIPAA Privacy & Security policy can be found here: <http://www.regis.edu/About-Regis-University/University-Offices-and-Services/Auxiliary-Business/HIPAA.aspx>.
- The Human Subjects Institutional Review Board (IRB) procedures. More information about the IRB and its processes can be found here: <http://regis.edu/Academics/Academic-Grants/Proposals/Regis-Information/IRB.aspx>.

The CC&IS Policies & Procedures Syllabus Addendum summarizes additional important policies including, Diversity, Equal Access, Disability Services, and Attendance & Participation that apply to every course offered by the College of Computer & Information Sciences at Regis University. A copy of the CC&IS Policies & Procedures Syllabus Addendum can be found here: <https://in2.regis.edu/sites/ccis/policies/Repository/CCIS%20Syllabus%20Addendum.docx>.

