MTH 362 - Advanced Engineering Math

Section 0001, Fall 2020

Course Information:

Instructor: Araceli Bonifant, bonifant@uri.edu

Textbook: Advanced Engineering Mathematics (10th Edition) by Erwin Kreyzig. (You may use either the URI custom edition or full textbook.)

Synchronous Zoom Meetings: TTh 9:30-10:45 A.M.

Office Hours: TBA

Course Description:

Algebra of complex numbers, matrices, determinants, quadratic forms. Linear differential equations with constant coefficients. (Lec. 3) Pre: MTH 142. Not for major credit in mathematics.

Course Goals and Learning Outcomes:

This course provides the foundation of the major tools used in some engineering classes. We will cover topics from Complex Analysis, Linear Algebra and Differential Equations. Our main objective is to understand the core concepts and become proficient in the use of the tools needed to solve different types of problems, which will be presented.

- **Complex Analysis:** Calculate basic operations of complex numbers such as: addition, multiplication and division. Compute powers, roots, exponentials and logarithms of such numbers.
- **Linear Algebra:** Solve systems of linear equations. Identify when two vectors are linearly independent. Construct a basis for a vector space. Find the rank and determinant of a matrix. Compute the eigenvectors and eigenvalues of a system of linear equations. Identify when a matrix is diagonalizable.
- **Differential Equations:** Select which equations are solutions to certain ODEs. Solve first and second order linear differential equations with constant and non-constant coefficients by using common techniques as integration factors. Identify those solutions which are linearly independent, compute eigenvalues and eigenvectors, and solve systems of ODEs.

Evaluation:

Final grades will be computed as follows:

Participation	**10%**	
Quizzes	**15%**	
Exam I	**20%**	**October, 15th.**
Exam II	**20%**	**November, 24th.**
Final Exam	**35%**	**Comprehensive Final Exam,**

There will be no extra credit available for this class. Missed assignments cannot be made up. See the University Manual for exceptions to this policy.

Letter Grade Distribution:

Final grades will be determined according to the following scale.

95 - 100 A	85 - 89.99 B+	70 - 74.99 C+	55 - 59.99 D+	0 - 49.99 F
90 - 94.99 A-	80 - 84.99 B	65 - 69.99 C	50 - 54.99 D	
	75 - 79.99 B-	60 - 64.99 C-		

Homework:

Assigned homework problems from the book appear at the end of this syllabus, but they will also be announced weekly in our Brightspace site. **Homework will be not graded but quiz content will be taken from these problems.** Questions about the homework will be addressed at the beginning of our Zoom meetings. It is the student's responsibility to complete all the assigned exercises and participate in office hours or ask in class if there are any questions.

Expectations:

- You are expected to attend every Zoom meeting, and read the material we will cover before hand since you need to be ready for our Zoom discussions of the material. Be aware, that you will need to cover a lot of information at a rapid pace. You will need to read two of the assigned sections before each of our synchronous meetings.
- It is your responsibility to communicate clearly in writing up solutions for quizzes and exams. Your results must display your understanding well and be written in a correct, complete, coherent, and well organized fashion. Show all your work!
- The pace of the class requires that you spend enough time every week doing homework, reviewing notes, reading the textbook, and working out extra problems, all in addition to attending our Zoom meetings.

Academic Honesty Policy.

Cheating is defined in the University Manual section 8.27.10 as the claiming of credit for work not done independently without giving credit for aid received, or any unauthorized communication during examinations. Students are expected to be honest in all academic work. The resolution of any charge of cheating or plagiarism will follow the guideline set forth in the University Manual sections 8.27.10-8.27.21. Furthermore, course content and outlines, exams, and assignments created by instructors shall be considered the instructors' intellectual property. Course materials shall not be distributed, shared in any public domain or third party website, or sold without prior written consent of the instructor. See the University Manual section 8.27.22.

Special Needs:

Any student with a documented disability is welcome to contact their instructor as early in the semester as possible so that reasonable accommodations may be arranged. As part of this process, please be in touch with Disability Services for Students Office at 302 Memorial Union, 401-874-2098 (`https://web.uri.edu/disability/`)

Academic Enhancement Center:

This is a challenging course. Success requires that students keep pace with the work, understand course concepts, and study effectively. The Academic Enhancement Center helps URI students succeed through three services: Academic Coaching, Tutoring, and The Writing Center. To learn more about any of these services, please visit `https://web.uri.edu/aec/` or call 401-874-2367 to speak with reception staff.

No Work Submitted and Incomplete Grades:

University of Rhode Island regulations concerning no work submitted and incomplete grades will be followed. See the University Manual section 8.53.12 regarding no work submitted and sections 8.53.20 and 8.53.21 regarding incomplete grades for details.

Religious Holidays:

It is the policy of the University of Rhode Island to accord students, on an individual basis, the opportunity to observe their traditional religious holy days. Students who plan to be absent from our Zoom meetings or examinations for religious holy days that traditionally preclude secular activity shall discuss this with the appropriate instructor(s) in advance of the holy day. See the University Manual section 8.51.11 for details.

Standards of Behavior:

Students are expected to treat faculty and fellow classmates with dignity and respect. Students are responsible for being familiar with and adhering to the published "Community Standards of Behavior: University Policies and Regulations" which can be accessed in the University Student Handbook
`https://web.uri.edu/studentconduct/university-student-handbook/`

Sections	**Assigned Problems**
13.1 - Complex Numbers and Their Geometric Representation	2, 4, 5, 10, 14, 16, 20
13.2 - Polar Form of a Complex Number	2, 5, 11 ,13, 15, 17, 21, 23, 29
13.5 - (Complex) Exponential Function	2, 5, 9, 13, 15, 16, 19, 21
13.7 - (Complex) Logarithm	5, 8, 13, 15, 18, 19, 23, 24
7.1 - Matrices, Vectors: Addition, Scalar Multiplication	11, 14, 16, 17, 18
7.2 - Matrix Multiplication	11, 12, 15, 18, 20
7.3 - Linear Systems of Equations, Gauss Elimination	1, 3, 5, 8, 11
7.4 - Linear Independence, Rank, Vector Spaces	1, 3, 9, 17, 19
7.5 - Solutions of Linear Systems: Existence, Uniqueness	
7.7 - Determinants, Cramer's Rule	5, 7, 9, 11, 17, 19, 21, 23
7.8 - Inverse of a Matrix, Gauss-Jordan Elimination	1, 5, 7, 11, 13, 15
8.1 - The Matrix Eigenvalue Problem; Eigenvalues, Eigenvectors	2, 5, 7,10, 11, 13
8.4 - Eigenbases, Diagonalization, Quadratic Forms	2, 4, 7, 9, 13, 14, 16
1.1 - Basic First Order ODE Concepts, Modeling	2, 5, 9, 13, 17
1.3 - Separable ODEs, Modeling	2, 5, 7, 8, 11, 16, 19, 25
1.4 - Exact ODEs, Integrating Factors	3, 5, 7, 9, 12, 13, 14, 15
1.5 - Linear ODEs, Bernoulli Equation, Population Dynamics	5, 7, 11, 12, 18, 22, 25, 28, 31
2.1 - Homogeneous Linear ODEs of Second Order	3, 5, 7, 9, 16, 17
2.2 - Homogeneous Linear ODEs with Constant Coefficients	1, 11, 14, 16, 18, 23, 25, 33, 35
2.5 - Euler-Cauchy Equations	2, 5, 8, 11, 13, 17, 18
2.6 - Existence and Uniqueness of Solutions, Wronskian	4, 6, 9, 12
2.7 - Nonhomogeneous ODEs	3, 5, 8, 12, 14, 16
2.10 - Solution by Variation of Parameters	3, 4, 5, 6, 10, 11, 13
3.1 - Homogeneous Linear ODEs	1, 4, 6, 9, 13
3.2 - Homogeneous Linear ODEs with Constant Coefficients	1, 3, 5
3.3 - Nonhomogeneous Linear ODEs	2, 5, 9, 11, 13
4.1 - Systems of ODEs as Models in Engineering Applications	1, 5, 10, 12
4.2 - Basic Theory of Systems of ODEs, Wronskian	
4.3 - Constant-Coefficient Systems, Phase Plane Method	1, 4, 9, 14