

MEC 507, Fall 2020:
Mathematical Methods for Engineering Analysis I

Instructor: Prof. George Whelan

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Office: GMU Korea Arts and Sciences # 549

Office Hours: Thursdays 10:00 am -1:00 pm (please email me if you would like to schedule a different time)

Class Room: A 116

Class Time: Tuesdays & Thursdays 5:00 pm – 6:20 pm

Textbook: Advanced Engineering Mathematics, Michael D. Greenberg, 2nd Edit. (1998) Prentice Hall (Publ.) ISBN 0-13-321431-1

Prerequisite: Graduate Standing in mechanical engineering, and/or permission of the instructor.

COVID-19 Statement: Stony Brook University Korea is following a hybrid in-class/online format. We will be meeting in-person on the odd number weeks: 1, 3, 5, 7, 9, 11, 13, and 15. On the even numbered weeks we will hold online classes. The online classes will be a combination of virtual meetings, lecture videos, readings, and assignments for your completion. We will discuss the online teaching strategy as the course progresses.

Course Description: This course serves as an introduction to the use of mathematical analysis techniques as they relate to engineering analysis problems, and the simulation of engineering systems. We will discuss both continuous and discrete methods. We will cover initial and boundary value problems for ordinary and partial differential equations. Topics we will cover will include (but not be limited to):

- **Functions of complex variables:** Cauchy-Riemann equations (complex-analytic functions), harmonic functions, multi-valued functions and branch cuts, Cauchy's theorem and integral formula, Taylor and Laurent series (singularities), residue theorem and contour integration
- **Calculus of variations:** Basic concepts, extremization of functionals, Brachistochrone problem, isoperimetric problem, constrained extremization, Hamilton's principle, applications
- **Linear mathematics:** Vector spaces (dimension and basis), inner product (and normed vector spaces), Gram-Schmidt orthogonalization, projections, change of basis, linear operators, linear equations, eigenvalues, eigenvectors, and diagonalization
- **Ordinary and partial differential equations (ODEs and PDEs):** Methods for ODE solution (review and expand upon what you have already studied in undergraduate methods), heat equation, wave equation, Laplace equation, applications of certain ODE solution methods as a way to solve PDEs via the method of separation of variables, Sturm-Liouville theory, ODEs (local analysis), Classification of ODEs, Methods of undetermined coefficients, Variation of parameters, series solutions of regular and regular singular equations
 - **NOTICE:** students are required to independently review the methods of separation of variables, Fourier series, and Laplace transforms. We will discuss a brief review of such topics, but you will need a working knowledge upon which you can build.

Assignments:

- **Homework:** We will have weekly homework assignments. You are permitted to work with other students, unless otherwise notified.

- **In-Class Assignments:** We will have occasional in-class assignments, particularly during the online even weeks. You are permitted to work with other students, unless otherwise notified.
- **Mid-term Exam:** We will have one mid-term exam, which will cover the first half of the course.
- **Final Exam:** We will have one final exam. It will have an emphasis on the second half of the course, but it will be cumulative and will include topics from throughout the semester.

Grading:

- Homework and Class Assignments: 30%
- Midterm Exam: 30%
- Final Exam: 40%

Your letter grade will be determined by your course average as follows:

$95 \leq A \leq 100$
$90 \leq A- < 95$
$85 \leq B+ < 90$
$80 \leq B < 85$
$75 \leq B- < 80$
$70 \leq C+ < 75$
$65 \leq C < 70$
$60 \leq C- < 65$
$55 \leq D+ < 60$
$50 \leq D < 55$
$0 \leq F < 50$

Student Accessibility Statement: If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact Student Accessibility Support Center, ECC (Educational Communications Center) Building, Room 128, (631) 632-6748. They will work with you to determine what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Student Accessibility Support Center. For procedures and information go to the following website: <http://www.stonybrook.edu/ehs/fire/disabilities>

Academic Integrity Statement: Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Sharing work with another student, unless permitted for a given assignment, will not be tolerated. Faculty members are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and the School of Medicine are required to follow their school-specific procedures. For more comprehensive information regarding academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website: https://www.stonybrook.edu/commcms/academic_integrity/index.html.

Critical Incident Management: Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior which interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

Tentative schedule (Subject to change):

<u>Week</u>	<u>Topics</u>	<u>Dates</u>
<u>Week 1</u> IN PERSON	Complex Variables	Aug 25, 27
<u>Week 2</u> ONLINE	Complex Variables	Sep 1, Sep 3
<u>Week 3</u> IN PERSON	Complex Variables	Sep 8, 10
<u>Week 4</u> ONLINE	Complex Variables, Calculus of Variations	Sep 15, 17
<u>Week 5</u> IN PERSON	Calculus of Variations	Sep 22, 24
<u>Week 6</u> NO CLASSES -Tuesday Correction day -Chuseok Holiday	NO CLASSES	NO CLASSES
<u>Week 7</u> IN PERSON	Calculus of Variations	Oct 6, 8
<u>Week 8</u> ONLINE	Calculus of Variations, Linear Mathematics Mid-Term Exam	Oct 13, 15
<u>Week 9</u> IN PERSON	Linear Mathematics	Oct 20, 22
<u>Week 10</u> ONLINE	Linear Mathematics	Oct 27, 29
<u>Week 11</u> IN PERSON	Linear Mathematics	Nov 3, 5
<u>Week 12</u> ONLINE	ODEs and PDEs	Nov 10, 12
<u>Week 13</u> IN PERSON	ODEs and PDEs	Nov 17, 19
<u>Week 14</u> ONLINE	ODEs and PDEs	Nov 24, 26
<u>Week 15</u> IN PERSON	ODEs and PDEs	Dec 1, Dec 3
<u>Week 15/16</u>	FINAL EXAM PERIOD	Dec 4-10