COURSE SYLLABUS

1 ECE 8001 - Engineering Math I

2 Meeting Information

3 credits, 3 contact hours One 150 min lecture per week

a. **Section 001:**
Lecture: Rfrom 05:30 pm to 08:10 pm Location: TBA,

b. **Section DL1:**
Lecture: Rfrom 05:30 pm to 08:10 pm Location: TBA,

3 Course Instructor(s), TA(s)

a. **Section 001:**
Class Instructor: Ahmad Hoorfar
Office Hours: Thursday 4:00 pm to 5:15pm (or by appointment) at Villanova. Also: questions can be asked via Email or via Zoom by appointment., or by appt.
TA: None

b. **Section DL1:**
Class Instructor: Ahmad Hoorfar
Office Hours: Thursday 4:00 pm to 5:15pm (or by appointment) at Villanova. Also: questions may be asked via Email or via Zoom by appointment., or by appt.
TA: None

4 Textbook

Erwin Kreyszig, *Advanced Engineering Mathematics, 10th edition*, John Wiley & Sons, 2011. ISBN: 978-0-470-45836-5. REQUIRED.

a. **Other Supplemental Materials:** Extensive "Hand-Out" Class Notes

b. **References:**

1. Francis B. Hildebrand, "Advanced Calculus for Applications, Prentice Hall, 2nd edition, 1976.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", PWS-Kent Publishing Company, 4th edition, 1995.

5 Specific Course Information

a. **Catalog Description**
Applied mathematics course tailored to the needs of EE graduate students. Topics: i) Complex variable theory, ii) Sturm-Liouville problem, eigen-function expansion and special functions, iii) Matrix theory, eigen value and diagonalization, iv) Fourier analysis, multi-dimensional Fourier series and transforms, and v) Partial differential equations. Various examples from engineering and physics will be incorporated as appropriate.

b. **Prerequisites:** Undergraduate level courses on calculus and differential equations; **Co-requisites:** None

c.

6 Course-specific Goals

a. This course is an applied mathematics course tailored to the needs of engineering graduate students. The course begins with a detailed treatment of complex variable theory, which includes Cauchy's theorem, classification of isolated singularities, multi-valuedness and branch-cut singularities, Taylor and Laurent series and contour integration methods for evaluation of integrals. Next, we introduce vector spaces and linear operators which then leads to an in-depth treatment of the following three topics: i) Series solution of differential equations and special functions (e.g.: Bessel, Hankel, Legendre, Gamma functions etc.), ii) Sturm-Liouville and boundary value problems, and iii) Generalized Fourier series, eigen-values and eigen-function expansion. These topics then lead to Fourier analysis, and multi-dimensional Fourier series and transforms. A study of partial differential equations, selected topics in higher dimensional calculus, variational calculus and Green's function theory (if time permitted) will conclude the course. Various examples from engineering and physics will be incorporated in the above topics as appropriate.

7 List of Covered Topics

1. Complex Variable Analysis and Residue Calculus
2. Linear Spaces and Linear Operators
3. Series solution of diff. equations
4. Bessel and Legendre Equations; Special functions
5. Boundary Value/Sturm-Liouville Problem and Eigenfunction Expansion
6. Matrix Theory
7. Multi-Dim. Fourier Analysis: Fourier Series and Transform
8. Partial Differential Equations
9. Green's function Theory, Potential Theory
10. Topics in Higher Dimensional Calculus, Calculus of Variations

8 Tentative Schedule

Tentative schedules for all sections follow. Be sure to refer to the schedule for your specific section, if more than one is provided.

Tentative Schedule for **All Sections**

Number of weeks (Tentative)	Topics
2.5	Complex Variable Analysis and Residue Calculus
1.5	Linear Spaces and Linear Operators
1	Series solution of diff. equations
1.5	Bessel and Legendre Equations; Special functions
1.5	Boundary Value/Sturm-Liouville Problem and Eigenfunction Expansion
0.5	Matrix Theory
1.5	Multi-Dim. Fourier Analysis: Fourier Series and Transform
2	Partial Differential Equations
1	Green's function Theory, Potential Theory
0.5	Topics in Higher Dimensional Calculus, Calculus of Variations

9 Grading Policy

Homework Problems 25%
Mid-term Exam 35%
Final Exam 40%

10 HW Assignment and Laboratory Report Submission Policy

Weekly homework assignments. There will be one mid-term and one final exam. Final exam will be 'take-home'.

11 Attendance Policy

Attendance in-class or watching the live streaming of lectures online is strongly recommended

Whenever possible, students should inform the instructor if they plan to be late or absent from class. In all cases, documentation is required to petition for *excused* absences to the Associate Dean for Student and Strategic Programs, Dr. Stephen Jones. The excused absence form is posted at: https://www1.villanova.edu/villanova/engineering/resources/undergraduates.html.

Excused absences do not count towards a failure in the course for first year students. Absence from class does not release the student from assigned work. Students who miss an in-class obligation such as an exam, a presentation, etc., due to an excused absence will not be penalized - the instructor may offer a make-up test, arrange an alternative time for a presentation, exempt a student from the assignment, or provide another arrangement. In the case of illness or injury, the form must be submitted within 24 hours of missing a class. The University's list of excused absences for all students includes the following:

1. Participation in NCAA athletic competitions
2. Participation in special academic events such as: conferences, field trips, project competitions, etc., and in official university business such as student representatives attending meetings related to university governance

3. Attendance at significant events of the immediate family such as: funerals, weddings, etc.
4. Religious holidays - see the University's policy on Religious Holidays
5. College-approved participation in placement activities such as: job interviews, graduate school interviews, job fairs
6. Legally required absence such as: jury duty, court appearance, short-term military service
7. Documented serious illness or disability

12 Examination Policy

The College of Engineering has adopted the following general examination guidelines:

1. Students must arrive before the start of the examination. Under exceptional circumstances a student may need to arrive late, but he/she can enter the examination room no later than five (5) minutes after the start of the exam.
2. Cell phones must be turned off until the student exits the examination room.
3. The official Villanova class attendance policy must be followed when requesting excuses for absences or lateness to an examination.
4. Each student must write and sign the following statement, "I have neither given nor received any unauthorized assistance in the completion of this examination."
5. For online examinations, the instructor may implement video proctoring or other measures to ensure academic integrity. For consent purposes, the instructor will inform students in advance if (s)he plans to use any form of video-proctoring and whether the examination will be recorded.

13 Academic Integrity Policy

The College of Engineering is committed to creating an environment of academic integrity and ethical decision-making that we hope is reflected in the actions of our students and graduates. As Villanova students, integrity is central to the University mission. As engineers, our code of conduct requires us to place honor and integrity at the forefront of everything we do. As engineering students, it is expected that you will begin to adopt these values and instill them into your work habits. Students violating the academic integrity policy will receive a zero on that assignment or exam and the violation will be reported to the Associate Dean for Academic Affairs. The University's academic integrity policy can be found on the following web page:
https://www1.villanova.edu/villanova/provost/resources/student/policies/integrity.html.

14 Adherence to the Student Code of Conduct

Students are expected to act in a professional and respectful manner to their fellow students, faculty, and staff. Students should become acquainted with and understand the responsibilities set forth in the Student Handbook, especially those in the sections on Policy and Regulations. Adherence to university regulations is expected and required for successful completion of the program of studies. Enforcement within the classroom of policies regarding classroom behavior is the responsibility of the faculty member. All other discipline problems are to be referred to the Dean of Students.

15 Online Expectations

To foster a professional environment, please wear appropriate clothes, mute if you are not talking to cut down on background noise, refrain from eating, and select an appropriate setting when we are meeting online.

16 Inclusive Classroom

This classroom is a place where you will be treated with respect; we welcome individuals of all ages, backgrounds, beliefs, ethnicities, gender, gender identities and expressions, sexual orientation, and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment to allow all among us to learn and flourish.

17 Students with Disabilities

It is the policy of the university to make reasonable academic accommodations for qualified individuals with disabilities. If you are a person with a disability (non-physical) please register with the office of Learning Support Services (LSS) by emailing Learning.support.services@villanova.edu or by phoning 610-519-5176 as soon as possible. Registration is *required* in order to receive accommodations.

The Office of Disability Services (ODS) collaborates with students, faculty, staff, and community members to create diverse learning environments that are usable, equitable, inclusive and sustainable. The ODS provides Villanova University students with physical disabilities the necessary support to successfully complete their education and participate in activities available to all students. If you have a diagnosed disability and plan to utilize academic accommodations, please contact and register with Gregory Hannah, advisor to students with disabilities at 610-519-3209 or visit the office on the second floor of the Connelly Center.

18 Tutoring Services

Villanova's tutoring services include The Writing Center, The Learner's Studio, and The Center for Speaking and Presentation. These services are offered free of charge to students. Drop in as-needed or book a regular weekly session to supercharge your academic success. Sessions can be 30 or 60 minutes in length.

Register for an account and book sessions in advance at villanova.mywconline.com. If you don't see your class listed, request a tutor for a missing subject at: tutorrequest.villanova.edu For more information, contact Juliana Struder at juliana.studer@villanova.edu or at 610-519-5862.

19 Electronics Policy

The use of electronic devices, such as phones, laptops, tablets, calculators, etc., during class is generally allowed, unless their use causes a disturbance to others. During examinations, the use of any electronic device is prohibited, unless it is expressly authorized by the instructor.

Students are prohibited from making any audio or visual recordings (including taking photographs) of lectures, discussions, or other classroom activities, unless a student (1) has written permission in advance from the instructor, or (2) is permitted to record under terms and conditions as approved by the University's Office of Disability Services or Learning Support Services. Students who have received approval to record classes as an academic accommodation must provide supporting documentation from the Office of Disability Services or Learning Support Services in

advance of any recording. Students may use authorized recordings only for the purposes of individual study in the course, and may not disseminate or share them with a wider audience without explicit permission.

20 Copyright Policy

The materials used in Villanova University courses ("Course Materials") generally represent the intellectual property of course instructors, third parties and/or the university which may not be disseminated or reproduced in any form for public distribution (e.g., sale, exchange, etc.) without the written permission of the course instructor. Course materials include all written or electronic documents and materials, including syllabi, current and past examination questions/answers, and presentations such as lectures, videos, slides, etc., provided by a course instructor. Course materials may only be used by students enrolled in the course for academic (course-related) purposes.

Published course readings (book chapters, articles, reports, etc.) available in "Blackboard" are copyrighted materials. These works are made available to students through licensed databases or fair use. They are protected by copyright law, and may not be further disseminated or reproduced in any form for distribution (e.g. uploading to websites, sale, exchange, etc.) without the permission of the copyright owner.

Follow these links for more information on Intellectual Property, Copyright, and Computer Acceptable Use.

21 Professorial Duties

It is important to note that teaching is one of the many duties that professors perform as part of their job responsibilities. In addition to teaching, professors perform research, advise graduate students, edit journals and review journal articles, serve on committees for the university and professional societies, travel to conferences to remain abreast of current developments and to present their results... to name just a few commitments.