VILLANOVA UNIVERSITY
MECHANICAL ENGINEERING DEPARTMENT

ME 8000 Spring 2018
Advanced Engineering Analysis II Dr. B.J. Sullivan

COURSE OBJECTIVE

The objective of this course is to provide the students with the additional mathematical skills beneficial in their continued pursuit of advanced study in the field of engineering. The course will focus on fundamental aspects and solution methods for a variety of topics. As appropriate, practical applications in mechanical engineering will be discussed, utilizing the mathematical tools of the topic.

TENTATIVE COURSE OUTLINE

Subject to change, the course outline is as follows:

Mtg	Date	Topic	Homework Assignment	Quiz / Exam
1	22 Jan	Integral Equations: Introduction and The Green's Function	HW #1	No Quiz
2	29 Jan	Integral Equations: Fredholm equations, Hilbert-Schmidt Theory	HW #2	Quiz 1 on HW #1
3	5 Feb	Integral Equations: Iterative and Approximate methods	HW #3	Quiz 2 on HW #2
4	12 Feb	Calculus of Variations: Maxima and Minima; Statement of the Basic Problem	HW #4	Quiz 3 on HW #3
5	19 Feb	Calculus of Variations: Constraints; Natural Boundary Conditions; Higher Order Problems	HW #5	Quiz 4 on HW #4
6	26 Feb	Calculus of Variations: Hamilton's Principle; Deformable Bodies; Approximate Methods	HW #6	Quiz 5 on HW #5
	5 Mar	Semester Recess – No Class	No	n/a
7	*12 Mar*	*Mid-Term Examination – In-Class*	*No*	*Exam #1*
8	19 Mar	Analytical Functions: Complex Variables, Cauchy -Riemann eqns, Cauchy integrals, Line integrals	HW #7	No Quiz
9	26 Mar	Analytical Functions: Laurent Series, Singularities, Residues	HW #8	Quiz 6 on HW #7
10	2 Apr	Analytical Functions: Real Definite Integrals, Practical Applications, Conformal Mapping	HW #9	Quiz 7 on HW #8
11	9 Apr	Perturbation Theory - Introduction, Asymptotic Series, Asymptotic Expansions	HW #10	Quiz 8 on HW #9
12	16 Apr	Perturbation Theory - Quadratic Eqns, Higher Order Eqns, Transcendental Eqns	HW #11	Quiz 9 on HW #10
13	23 Apr	Perturbation Theory - Integrals	HW #12	Quiz 10 on HW #11
14	30 Apr	Perturbation Theory - Ordinary Differential Equations	HM #13	Quiz 11 on HW #12
15	*7 May*	*Final Examination – In-Class*	*No*	*Exam #2*

COURSE CONDUCT

Lecture notes, the student's own solutions to suggested assigned homework problems, and assigned reading from the textbook, (in that order) form the primary sources of information for the students. Accordingly, students are strongly advised to supplement the lecture material by working selected problems either suggested by the instructor from the textbook or distributed in class. Note, however, that homework will be neither collected nor graded. Solutions to all suggested problems are available to all students on the course website. If students are unable to obtain the problem solution and/or have difficulty understanding the solution provided, they are then encouraged to contact the instructor.

Supplementary materials (handouts) are associated with many of the lectures and may be obtained by the student via the web page for this course: http://vucoe.drbriansullivan.com/me-8000/. Students are advised to download and print out the lecture handouts prior to each class and to bring the lecture notes with them to class. Homework assignments, homework solutions, quizzes and quiz solutions (after they have been taken in class) will also be available on the course webpage.

Each student's final grade for this course is determined on the following basis:

Weekly Quizzes	10%
Mid-Term Examination	45%
Final Examination	45%

Note: All quizzes and all examinations are closed book and closed notes. The results of all quizzes and both tests are used in computing the final course grade. Please note that no quiz or test scores are dropped and no extra credit is available.

Weekly quizzes will be based on suggested homework assignments from the previous lecture.

The Final Examination will be a comprehensive exam – any topic may be included in this exam.

GRADES

Final course grades are assigned using Villanova University scale, repeated below for clarity.

Course Numerical Average	Final Letter Grade
93.3-100	A
90-93.3	A-
86.7-90	B+
83.3-86.7	B
80-83.3	B-
76.7-80	C+
73.3-76.7	C
70-73.3	C-
<70	F

COURSE TEXTS

Due to the diversity of topics being discussed in this course, several different books have been used to develop the course notes. The following books have been selected as required texts:

F.B. Hildebrand, Methods of Applied Mathematics, Dover Publications, Inc., 2nd Edition, 1992, ISBN 0-486-67002-3.

F.B. Hildebrand, Advanced Calculus for Applications, 2nd Edition, Prentice-Hall, 1976. ISBN 0-13-011189-9.

A.H. Nayfeh, Introduction to Perturbation Techniques, Wiley-VCH, 2004, ISBN 0-471-31013-1.

INSTRUCTOR AVAILABILITY

The best way to contact me is to send me an email (brian.sullivan@villanova.edu). I will respond as promptly as possible.

Please note that work does take me out of town, usually in the middle of the week, on average, for part of approximately two to three weeks each month. Except in the case of unplanned trips, students will be advised when I will be out of town so that they are not waiting too long for responses to e-mail messages.