FACULTY OF APPLIED SCIENCE AND ENGINEERING

Department of Mechanical and Industrial Engineering

MIE 1801H - ENGINEERING ANALYSIS III

Spring 2017

Instructor: Professor Andreas Mandelis
Office #: Mechanical Building (MC) Room 334
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Office Hours: 4:30 – 5:30 in Room 51E (basement of Mech Bldg.)
Lecture: Tuesday 4:30 – 6:30 pm in MC 306

Grade Composition:	Midterm Test:	35%
	Final Exam:	45%
	Problem Sets:	20%

Texts:

No single text is recommended, however, lecture material will be drawn from the following sources, in the Engineering Library. The books are on 2-hour reserve in the Library.

1. J. Mathews and R.L. Walker, *"Mathematical Methods of Physics"*, 2nd Ed., 1970. QA/401/M425, ENG.
2. R.E. Collins, *"Mathematical Methods for Physicists and Engineers"*, 1968. QA/401/C62 PASC PHYS.
3. L.P. Smith , *"Mathematical Methods for Scientists and Engineers"*, 1953. QA/401/S5/1961 ENG.
4. P.M. Morse and H. Feshbach, *"Methods of Theoretical Physics"*, Vol. I, 1953. QC/20/M6 PHYS, SIGS, ENG.
5. V. Arpaci, *"Conduction Heat Transfer"*, 1966. TJ/260/A7, ENG.

Additional references for further reading for those who are interested and motivated:

A. J. Sommerfeld, *"Partial Differential Equations in Physics"*, Academic, New York, 1949.
R. V. Churchill, *"Fourier Series and Boundary Value Problems"*, 3rd Ed., McGraw-Hill, New York, 1978.
G. F. D. Duff and D. Naylor, *"Differential Equations of Applied Mathematics"*, Wiley, New York, 1966.
F. B. Hildebrand, *"Methods of Applied Mathematics"*, Prentice-Hall, Engelwood Cliffs, 1952.
S. G. Mikhlin, *"Integral Equations"*, Pergamon Press, New York, 1957.
W. V. Lovitt, *"Linear Integral Equations"*, Dover Publications, New York, 1950.

Course Content:

I. Review of Solutions to Partial Differential Equations

a) Review of Separation of Variables
(M&W, Chap. 8-3; Collins, Chap. 5; Arpaci, Chap. 4-1)
b) Eigenfunctions and Eigenvalue Problems
(Arpaci, Chap. 4-1; M&W, Chap. 9-1, 2)

II. Green Functions and Solutions to Boundary-Value Problems in One and Higher Dimensions

(M&F, Chap. 7; M&W, Chap. 9-4; Collins, Chap. 10)
a) Nonhomogeneous boundary-value problems; the Dirac delta function.
b) One-dimensional Green functions.
c) Green functions in higher dimensions.
d) Boundary-value problems in diffusion and wave fields using Green functions.

Choice of one of the following topics, depending on remaining time available

III. Variational Methods

a) Euler-Lagrange equation and applications to eigenvalue problems
(Smith, Chap. 15; Collins, Chap. 12)
b) Variational formulations of Sturm-Liouville and Diffusion equations
(Smith, Chap. 15; Arpaci, Chap. 8)
c) Rayleigh-Ritz method and approximate solutions to P.D.E.'s
(Smith, Chap. 15)

IV. Integral Equations and their use in Solutions of Boundary-Value Problems

a) Classification
(M&W, Chap. 11-1, 2)
b) Integral equations of 1st. and 2nd kinds.
Fredholm and Volterra equations
(Smith, Chap. 14; Collins, Chap. 11)
c) Homogeneous and non-homogeneous integral equations
(Smith, Chap. 14)