

FACULTY OF APPLIED SCIENCE AND ENGINEERING

Department of Mechanical and Industrial Engineering

MIE 1801H - ENGINEERING ANALYSIS III

Spring 2021

Instructor: Professor Andreas Mandelis

Office #: Mechanical Building (MC) Room 334

Phone #: 978-5106; e-mail: mandelis@mie

Office Hours: By appointment in my office Room 334 Mech Bldg.

Lecture: TBD

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

Texts:

No single text is recommended, however, lecture materials 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., QA/401/M425, ENG.
2. R.E. Collins, "*Mathematical Methods for Physicists and Engineers*", QA/401/C62 PASC PHYS.
3. L.P. Smith, "*Mathematical Methods for Scientists and Engineers*", QA/401/S5/1961 ENG.
4. V. Arpaci, "*Conduction Heat Transfer*", TJ/260/A7, ENG.

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)