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.


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)