January 2003

58:214 (53:214) Analytical Methods in Mechanical Systems

2002/04 Catalog (Revised)	58:214 (53:214) Analytical Methods in Mechanical Systems	3 s.h.
Description:	Matrices; vector spaces; eigenvalue problems; quadratic forms; minimum principles; function spaces; linear operators; variational methods; applications of functional analysis to the engineering problems; functionals and operators in Hilbert spaces; calculus of variations with the applications to mechanics; boundary value problems; variational methods such as the Ritz and Galerkin methods.	
Textbook:	Haug, E.J. and Choi, K.K., Methods of Engineering Mathematics, Prentice Hall Inc., Englewood Cliffs, N.J., 1993.	
Coordinator:	K. K. Choi, Professor of Mechanical and Industrial Engineering	
Goals:	Develop competency in theories and applications of advanced modern mathematical methods in mechanics.	

Prerequisite by Topic: 58:113

Topics (Class Hours):

1. Vector spaces
2. Eigenvalue problems and quadratic forms
3. Function spaces
4. Linear and metric spaces
5. Square-integrable function spaces
6. Hilbert space
7. Functionals and linear operators in Hilbert spaces
8. Minimum of a quadratic functional
9. Calculus of variations
10. Orthonormal series representations
11. The Ritz method
12. Other variational methods
13. The eigenvalue problem in function spaces

Computer Usage: None
Laboratory Project: None

Estimated ABET Category Content: Not applicable

Prepared by: K.K. Choi Date: January 2003

Average Class Hours Per Week: Lecture 3.0, Discussion 0
Laboratory 0, Other 0, Total 3.0

Teaching Aids, Facilities, and Instrumentation Used: None

Objectives, Approach, and Perspective of Course:

Students develop working knowledge of mathematical theory and techniques that are needed for the study of solid mechanics. The approach is modern in nature, employing vector space, function space, functional analysis, and variational methods for finite and infinite dimensional systems. The mathematical level of sophistication is consistent with the needs of the advanced engineering graduate student. The perspective of the course is one of solid mechanics, with consistent applications employed throughout to provide clear illustrations of the applications of abstract concepts of modern mathematical tools to engineering problems in mechanics.

Programs Served:

Mechanical Engineering, Civil and Environmental Engineering, and Biomedical Engineering

Students Served:

Advanced graduate students

Frequency of Offering:

Once in two years