ENG ME 400 Engineering Mathematics

2008 - 2009 Catalog Data:
ENG ME 400 Engineering Mathematics Prereq: CAS MA 226. Mathematical methods and concepts applied to the modeling and solution of engineering problems. Vector calculus, complex variables, partial differential equations, and matrix algebra. 4 cr.

Class/Lab Schedule: 4 lecture hour per week

Status in Curriculum: Required

Textbook(s) and/or Other Required Material: M.S. Howe, Mathematical Methods for Mechanical Sciences.

Coordinator: M.S. Howe, Professor, Mechanical Engineering

Prerequisites by Topic:
1. Multivariate calculus
2. Ordinary differential equations

Goals:
This course introduces students to the principal mathematical methods used in the modeling and analysis of engineering problems. A good understanding of these methods will prepare the undergraduate engineer to formulate ideas mathematically, understand and interpret mathematical models in technical memos, and to communicate mathematical arguments relating to engineering systems in a clear and logical manner.

Course Learning Outcomes:
As an outcome of completing this course, students will:

i. Acquire a knowledge and basic understanding of the principal mathematical methods used in the modeling of mechanical and aerospace systems. The course will extend and expand upon the students'; previous study of vector algebra and calculus, real variable calculus and differential equations. (A)
ii. Be proficient in the application of vector algebra, calculus and integral calculus to the resolution of physical and geometric problems. Such problems are encountered in other courses and a proper grasp of fundamentals is therefore essential. (A)
iii. Be proficient in the application of methods of complex variables to physical problems. In particular, the use of residue theorem for the evaluation of integrals, especially with regard to Fourier analysis. (A)
iv. Be proficient in the application of real and complex methods to the solution of the partial differential equations of engineering science, including equations of heat transfer, Laplace and wave motion. (A)
v. Demonstrate an ability to communicate in writing an understanding of mathematical concepts and their physical interpretations. Students will be assigned at least four essays on various topics in engineering mathematics. (G)

Course Learning Outcomes mapped to Program Outcomes:
(For Program Outcomes, please see attached page or Department Web Site)

Program:	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Course:	i-iv	-	-	-	i-iv	-	v	-	-	-	-	-	-	-
Emphasis:	5	1	1	1	3	1	3	1	1	1	1	1	1	1

Topics (time spent in weeks):
1. Vector calculus: elementary vector operations; vector fields, gradient, divergence, and curl, divergence theorem, Stokes' theorem, Green's identities, evaluation of line and surface integrals. (3)
2. Complex variables: analytic functions, Cauchy-Riemann equations, singularities, Cauchy's theorem and series expansions, residue theorem and its application to evaluate integrals. (4)
3. Partial differential equations: wave diffusion and Laplace equations, characteristics, d'Alembert's solution to wave equation, generalized Fourier series derived from Sturm-Liouville theory, eigenvalues and solution by eigenfunction expansions, simple applications of generalized functions, solution by full and half-range Fourier transforms. (6)
4. Review (1)

Contribution of Course to Meeting the Professional Component:
Engineering Topics: 100%

Status of Continuous Improvement Review of this Course:
Date: Spring 2009 **Reviewed by:** ME Undergraduate Comm.
Prepared by: M.S. Howe **Date:** April 27, 2009.