MEC 507 Mathematical Methods in Engineering Analysis I

Fall 2018

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155 Light Engineering
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Class Time and Location: TH: 4:00 – 6:50 p.m., MELVILLE LBR E4315

Instructor Office Hours: Mondays & Wednesdays 11 AM– 12:30 PM (Office LE 155)

Suggested Textbooks:
Advanced Engineering Mathematics, Michael D. Greenberg, 2nd Ed. (1998) Prentice Hall, ISBN 0133214311.
Advanced Engineering Mathematics, Erwin Kreyszig, 10th Ed. (2002), John Wiley & Sons, ISBN 9780470458365.

Prerequisite: Graduate standing in an engineering major.

Course Description: An introduction to mathematical theories, analysis, and solution techniques for fundamental engineering applications. This course is required for preparations for the PhD math qualifying exam.

1. **Ordinary Differential Equations (ODEs) (3 Lectures):** Basic concepts. Solution techniques for linear ODEs with application to specific engineering problems. Homogeneous and non-homogeneous equations. Power series solutions. Solution via special functions. Laplace Transform. Non-linear ODEs. Numerical solution methods for ODEs.

2. **Linear Algebra (2 Lectures):** Basic concepts, matrices, vectors, determinants. Solution of linear systems. Eigenvalues and eigenvectors. Eigenbases and diagonalization.

3. **Scalar and Vector Field Theory (2 Lectures):** Differential calculus of multivariable functions. Divergence, gradient, curl, Laplacian. Maximization/minimization; Euler-Lagrange equation and Lagrange multipliers. Integration on curves, surfaces, and volumes. Gauss and Stokes theorems. Green's theorem.

4. **Partial Differential Equations (3 Lectures):** Fourier Series/Transforms. The Sturm-Liouville problem. Separation of variables. Diffusion and Wave equations. D'Alembert's solution.

5. **Functions of complex variables (3 Lectures):** Functions of complex variables. Polar form. Conformal mapping. Complex integral calculus. Cauchy integral formula. Taylor series, Laurent series and the residue theorem.

Grading (A/F):
Homework & Class assignments: 30%, **Midterm**: 30%, **Final Examination*:** 40%,

*As this class must prepare students for the PhD qualifying exam, the mid-term and final examination will be closed-book and there will be restrictions on the use of laptops, mobile devices, and certain calculators (see http://www.ncees.org/exams/calculators/ for list of allowed calculators).

DISABILITY SUPPORT SERVICES (DSS) STATEMENT

Course Learning Outcomes/Objectives

Upon completion of this course, students will be able to:

1. Understand fundamental concepts and apply solution techniques for ODEs and PDEs relevant to engineering applications.
2. Understand fundamental concepts and employ methods to operate with matrices, vectors, and tensors.
3. Understand and employ methods to perform differentiation and integration in 3D scalar and vector fields over curves, areas, and volumes.
4. Understand and apply series expansions based on orthogonal functions (e.g., Fourier series) for harmonic analysis and solution of PDEs.
5. Understand and employ operations using complex numbers.

DISABILITY SUPPORT SERVICES (DSS) STATEMENT

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, room128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential. Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website: http://www.stonybrook.edu/ehs/fire/disabilities]

ACADEMIC INTEGRITY STATEMENT:

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/

CRITICAL INCIDENT MANAGEMENT:

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.