The George Washington University
Washington, D.C.

ApSc 6213 – Analytical Methods in Engineering III
Partial Differential Equations

Fall 2012 – Main Campus

References: *Partial Differential Equations with Fourier Series and Boundary Value Problems*, Second Edition, by N.H. Asmar (Pearson Prentice Hall, 2004), ISBN 978-0131480964; *Fourier Series and Boundary Value Problems*, Eighth Edition, by J.W. Brown and R.V. Churchill (McGraw-Hill, 2011), ISBN 978-0078035975.

Notes: *Analytical Solution of Partial Differential Equations* by G.C. Everstine

Instructor: Gordon C. Everstine, `http://gwu.geverstine.com`
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Schedule: Wednesdays, Aug. 29 – Dec. 19, 3:30 p.m. – 6:00 p.m.
No class: Nov. 21 (Thanksgiving)
Mid-Term Exam: Oct. 17
Final Exam: Dec. 19

Description: Analytical techniques for solution of boundary-initial-value problems in engineering; wave propagation, diffusion processes, and potential distributions.

Objectives: To understand the derivation and applicability of the classical partial differential equations of engineering; to increase knowledge of the nature of solutions of equations of different types; to learn how to solve various equations analytically.

Grading: Assignments 1/3, mid-term exam 1/3, final exam 1/3. All graded work must be completed in accordance with the GW Code of Academic Integrity (`http://www.gwu.edu/~ntegrity/code.html`). Students are encouraged to discuss the meaning of assignments and general approaches and strategies for handling those assignments, but it is not acceptable to share solutions.

Course Outline

1. Review of notation and integral theorems; the divergence theorem; Green's theorems
2. Derivation of wave and heat equations; elastodynamics; initial conditions and boundary conditions; uniqueness; classification of partial differential equations
3. Fourier series; expansions in orthogonal functions; generalized Fourier series; completeness
4. Problems in Cartesian coordinates; transient and steady-state problems; nonhomogeneous equations
5. Sturm-Liouville systems; orthogonality of eigenfunctions
6. Orthogonal curvilinear coordinates
7. Problems in cylindrical coordinates; Bessel's equation
8. Problems in spherical coordinates; Legendre's equation