MATH 6702 Math Methods in Applied Sciences II

Spring 2013

MW 4:30-6:00 Sustainable Education 110.

Professor Federico Bonetto

Office Hours: MW 6-7, classroom.

Review of vector calculus and and its application to partial differential equations.

The text that will be used is:

Advanced Engineering Mathematics by Dennis G. Zill, Warren S. Wright, Jones & Bartlett Learning.

The syllabus can be found here.

There will be two midterm.

The exercise listed are for HW collection. I will collect them every two weeks and grade 2 or 3 exercises among the one assigned. In the list of assigned problems below the number in square braskets refer to the 4th and 3rd editions of the textbook.

The final grade will be based on the following rules: 45% final, 35% midterms, 20% HW. Curving will be done on the final result.

Arguments covered.

- Multidimensional Calculus
    - Curves and surfaces, gradients, divergence and curl
    - Taylor expansions in IR3
    - Divergence and Stokes theorem
    - Classification of partial differential equations
    - The concept of well-posed problems
- Potential Problems
    - Derivation of Laplace's equation; Dirichlet and Neumann problems
    - The maximum principle and uniqueness of solutions
    - Green's identities and Green's functions for selected domains
    - Connections to variational problems and complex variables
- Parabolic Problems
    - Derivation of the heat equation in IR3; discussion of boundary and initial conditions; the maximum principle for the heat equation and uniqueness of solutions; fundamental solution for pure initial value problems; Duhamel's principle for inhomogeneous equations
- Hyperbolic Problems
    - The concept of characteristics for a single first order equation
    - Solution of initial value problems; the concept of a shock
    - D'Alembert solution of the wave equation; Huyghen's principle and the solution of the wave equation in IR3

First week

Material covered:

- 9.1 Vector Function
- 9.2 Motion on a curve
- 9.3 Curvature and component of the acceleration

Exercises:

- (9.1): 19, 26, 31, 36
- (9.2): 6, 8, 21 [17], 26 [22]
- (9.3): 4, 21, 22

Second week

Material covered:

- 9.4 Partial Derivatives
- 9.5 Directional Derivative
- 9.6 Tangent Planes and Normal Lines

Exercises:

- (9.4): 33, 43, 55
- (9.5): 29, 39, 40
- (9.6): 21, 22, 38

Third week

Material covered:

- 9.7 Curl and Divergence

Exercises:

- (9.7): 36, 43, 44

Fourth week

Material covered:

- 9.8 Line Integrals
- 9.9 Independence of the Path

Exercises:

- (9.8): 30, 37, 39
- (9.9): 17, 18, 21

Fifth week

Material covered:

- 9.10 Double Integrals
- 9.11 Double Integrals in Polar Coordinates

Exercises:

- (9.10): 19, 23, 61
- (9.11): 15, 29, 34

Sixth week

Material covered:

- 9.12 Green's Theorem
- 9.13 Surface Integrals
- 9.14 Stokes' Theorem

Exercises:

- (9.12): 8, 12, 28
- (9.13): 13, 18, 43
- (9.14): 8, 15, 18

The first midterm will be on Wednesday Febraury 20. Here is the <u>solution set.</u>

Seventh week

- Review class and midterm.

Eighth week

Material covered:

- Midterm solution set.
- 9.15 Triple Integrals

Exercises:

- (9.15): 14, 32, 76

Nineth week

Material covered:

- 9.16 Divergence Theorem
- 9.17 Change of Variables in Multiple Integrals
- Review.

Exercises:

- (9.16): 11, 15, 22
- (9.17): 10, 16,27

The second midterm will be on Wednesday April 3. Here is the <u>solution set.</u>

Tenth week

Material covered:

- 12.1 Orthogonal function.
- 12.2 Fourier Series.
- 12.3 Fourier Cosine and Sine Series.

Exercises:

- (12.1): 11, 21, 22
- (12.2): 5, 12, 17
- (12.3): 30, 32, 49

Eleventh week

Spring Break.

Twelfth week

Material covered:

- 13.5 Laplace's Equation.
- The Maximum Principle and Green Functions.

Exercises:

- (13.5): 4, 6, 13

Projects for extra credit. Please, if you decide to turn in extra credit, choose one of this problems or let me know one of you choice.

Thirteenth week

Material covered:

- 13.3 Heat Equation.
- 14.1 Problems in Polar Coordinates.

Exercises:

- (13.3): 3, 5, 6
- (14.1): 2, 7, 13

Fourteenth week

Material covered:

- 13.4 Wave Equation.
- 14.2 Problems in Cylindrical Coordinates

Exercises:

- (13.4): 2, 4, 12
- (14.2): 9, 17