MAE/MSE 502 Partial Differential Equations in Engineering
Fall 2017 Monday/Wednesday 6:00-7:15 PM, Classroom: SCOB 228

Instructor: Huei-Ping Huang (hp.huang@asu.edu), ERC 359
Office hours: Monday 4-5 PM, Tuesday 3-5 PM, or by appointment

Course website http://www.public.asu.edu/~hhuang38/MAE502.html

Course Outline

I. Analytic solution of linear PDE

1. Overview of PDE
   Commonly encountered PDEs in engineering and science
   Types of PDEs, the physical phenomena they represent, and relevant boundary conditions
2. Method of separation of variables; eigenfunction expansion
3. Short review of Sturm-Louville Problem and orthogonal functions;
   Representation using orthogonal basis
4. Fourier Series
   Solution of ODE and PDE by Fourier Series expansion
5. Fourier transform and other integral transform methods
   Solution of PDE by Fourier transform; Behavior of solution in spectral space
6. PDE in non-Cartesian geometry
7. Forced problem and brief introduction to Green's function

II. Additional topics

8. Brief introduction to nonlinear PDE
   Examples of nonlinear PDEs for real world phenomena; Behavior of their solutions; Conservation laws
9. Method of characteristics; Solution of first order PDE

Textbook: *Applied Partial Differential Equation*, by R. Haberman, **Required**
Additional lecture notes/slides will be provided by instructor

Additional recommended textbooks:

(1) *Partial Differential Equations for Scientists and Engineers*, by S. J. Farlow (Dover Publications) This is a very well-written book that is ideal for self-study. It is also very cheap (~ $10 new).

(2) The first four chapters of *Partial Differential Equations: 2nd Edition*, by L. C. Evans (American Mathematical Society) This is a more advanced book intended for math majors. Nevertheless, the material in the first four chapters serve as a more rigorous supplement to Haberman's book. This book is recommended only for those who are really into math and want to learn more. NOT suitable as a study guide for improving grade, etc.

Requirement of programming using Matlab or equivalent: Although this course will focus on analytic solutions, some more complicated computations in the homework assignments will require programming using Matlab (or other programming languages/tools such as Fortran, C++, Python, Java, Mathematica, R, Octave). A beginner's guide for Matlab will be posted to the class website.

Grade: Homework 50% Midterm 20% Final 30%
Specific rules for collaboration on homework will be released at a later time

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Useful links

Please make sure that you are familiar with **ASU policies on academic integrity** and campus safety:

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ASU policy on academic integrity: https://provost.asu.edu/academicintegrity
Campus safety and security: https://provost.asu.edu/University-Safety-Security
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Grade and grading policies, contacts of SEMTE advising office:

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Grade and grading policies: https://students.asu.edu/grades
SEMTE advising: http://semte.engineering.asu.edu/advising/
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ASU website for software:

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https://apps.asu.edu (login required)
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