Math 7/8504
Partial Differential Equations. Fall 2019

- **Instructor**: Irena Lasiecka. DH 373, lasiecka@memphis.edu
- Time: M-W, 4:00-5:25 PM, DH 107
- **Course Description** :

  This course provides an introduction to qualitative theory of partial differential equations. The goal is to introduce students to various methods employed in qualitative studies PDE's -with particular emphasis on elliptic systems. The methods under consideration include: variational methods, perturbation methods, contraction mapping principles and Faedo-Galerkin methods. Questions such as existence, uniqueness and stability of solutions will be dealt with. Methods discussed include:

  - Introductory examples of PDEs and their solutions in some special cases.
  - Theory of distributions.
  - Sobolev spaces : embeddings, compactness, density , trace theory
  - Variational methods based on optimization and projections.
  - Variational Inequalities, Lax Millgram Theorem and applications.
  - Systems of elliptic PDEs.
  - Spectral analysis of elliptic solutions.
  - Maximum principle.
  - Galerkin Methods.

- **Textbooks**:

  1. Chapter 1-3 from S. Kesavan, *Topics in Functional Analysis and Applications*- S. Kesavan, John Wiley, 1989. **Alternatively**
  2. Chapters 8-9 from Haim Brezis, *Functional analysis, Sobolev spaces and partial differential equations*. Universitext. Springer, New York, 2011. **Alternatively**:
  3. Chapters 7-9 from Sandro Salsa *Partial Differential equations in Action* , 3-rd edition, Springer, 2016.

NOTE: Books 2 and 3 can be bought from Springer Link as MyCopy Softcover for $ 24 each . You have to login with UM email. I have just bought one and received in my office within 3 days. Content-wise 2 and 3 are very similar. Book 1 is a more compact version of chapters 8-9 from Brezis or Chapters 7-9 from Salsa. Good for students who do not like to read much and prefer very focused succinct presentation. The advantage of 2 and 3 is that it provides very comprehensive treatment including a lot of background material in analysis,

- **Grades**: Based on three assigned HW. Students are encouraged to work in a group. However, solutions to the HW's are expected to be written individually. 8504 students are expected to give additionally a presentation on a selected topic.

- **Prerequisite**: Real Analysis 7351-7352. Functional Analysis desired but not required.

Disability Statement: The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in Wilder Tower.