Department of Mathematical Science
Carnegie Mellon University

21-272 - Introduction to PDEs

Spring 2017

- **Jan 16**: **Martin Luther King day - no classes**
- **Jan 18**: Introduction and motivations
- **Jan 20**: Recall of preliminaries

- **Jan 23**: Transport equation (TE) - derivation, constant and variable coefficients
- **Jan 25**: TE - inhomogeneous problems (the Duhamel's principle)
- **Jan 27**: TE - review and exercises

- **Jan 30**: Diffusion equation (DE) - derivation, derivation of the heat kernel
- **Feb 1**: DE - derivation of the heat kernel
- **Feb 3**: DE - homogeneous global Cauchy problem in the whole space

- **Feb 6**: DE - bounded domains - separation of variables
- **Feb 8**: DE - separation of variables and exercises
- **Feb 10**: Wave equation (WE) - derivation and d'Alembert formula

- **Feb 13**: WE - causality, speed of propagation, reflection of waves
- **Feb 15**: WE - bounded domains - separation of variables
- **Feb 17**: Exercises on TE - DE - WE

- **Feb 20**: Fourier series (FS) - computation of the coefficients
- **Feb 22**: FS - proof of the pointwise convergence theorem in the regular case
- **Feb 24**: FS - convergence theorems

- **Feb 27**: FS - convergence theorems and justification of the solution of the wave equation
- **Mar 1**: Review in preparation of the midterm
- **Mar 3**: **FIRST MIDETERM**

- **Mar 6**: Correction of the midterm
- **Mar 8**: FS - general review
- **Mar 10**: **Spring break - no classes**

- **Mar 13 - Mar 15 - Mar 17**: **Spring break - no classes**

- **Mar 20**: FS - properties and justification of the solution of the heat equation
- **Mar 22**: Inhomogeneous problems for HE and WE in the whole space
- **Mar 24**: Inhomogeneous problems for HE and WE in bounded domains

- **Mar 27**: Laplace equation (LE) - principal properties
- **Mar 29**: LE - polar coordinates
- **Mar 31**: LE - Spherical coordinates, Laplace and Poisson equation in the whole space: fundamental solution

- **Apr 3**: LE - bounded domains, maximum principle and uniqueness
- **Apr 5**: LE - Poisson's formula for balls
- **Apr 7**: LE - problems in rectangles

- **Apr 10**: Exercises in preparation of the midterm
- **Apr 12**: Divergence theorem
- **Apr 12**: **SECOND MIDETERM**
- **Apr 14**: Divergence theorem
- **Apr 17**: Divergence theorem and Greens identities
- **Apr 19**: Representation formula in bounded domains
- **Apr 21**: **Carnival - no classes**
- **Apr 24**: Greens functions
- **Apr 26**: Distributions
- **Apr 28**: Distributions
- **May 3**: Fourier transform
- **May 5**: Fourier transform and applications to PDEs
- **May 7**: General review of the course