

## Topics for final exam

- First order systems
  - linear and nonlinear
  - characteristic curves , compatibility condition
- Fourier Expansion
- Wave Equation - 1D
  - infinite domain - D'Alembert
  - semi-infinite, even and odd functions
  - bounded domain - Fourier
  - Dirichlet, Neumann and Robin boundary conditions
  - forcing term - Duhamel's principle
  - properties
    - \* characteristics
    - \* well-posedness
    - \* domain of influence
    - \* domain of dependence
    - \* conservation of energy
    - \* propagation of singularities
- Parabolic Equation - 1D
  - explicit solution via convolution with Gaussian
  - maximum principle
  - energy
  - uniqueness
  - infinite and semi-infinite domains
  - bounded domain - Fourier
  - forcing terms, Duhamel
- Sturm Liouville
  - properties of eigenvalues and eigenvectors
  - convergence of series of eigenfunctions
  - integration & differentiation of series
  - Gibb's phenomena

- Multi-dimensions
  - separation of variables - convergence
  - forcing terms, eigenfunction expansion, Duhamel
- Elliptic Equations
  - Separation of Variables
  - Maximum Principle
  - Poisson formula
  - Rayleigh Quotient
- Bessel & spherical harmonic functions
- Helmholtz equation
- Green's functions
- Distributions
  - definitions
  - PDEs with delta functions