Spring 2008, MATH 108 SYLLABUS
Weekly Coverage and Homework Assignments
Instructor: Prof. Jian-Guo Liu

Weak 1: January 7 – 9.

- Introduction. Direction fields; ODE; the method of separation of variables; the method of undetermined coefficients.
- Basic mathematical models: the example of the field mice in **§1.1-2** illustrates the important process of converting a "scientific" problem to a math problem and solving it.
- **Homework Assignments:**
  §1.1 11;
  §1.2 3, 11;
  §1.3 6,12.

Weak 2: January 14 – 18.

- Integrating Factors
- Separable Equations. Illustrate "long" and "short" methods of solution, explaining how the change of variables in the integral justifies treating "dx" and "dy" independently.
- Modeling: a mixing tank problem
- **Homework Assignments:**
  §2.1 1, 4, 14, 20, 28, 33
  §2.2 1, 3, 7, 13, 16, 21, 31, 34, 36
  §2.3 2, 8, 9,1 0

Weak 3: January 21 – 25.

- Existence and Uniqueness. Emphasize understanding the statement of the theorems.
- Autonomous Equations and Population Dynamics. Besides the important example here, critical points and stability are introduced. Understand the qualitative solution of ODEs, and draw phase lines.
- Exact Equations and Integrating Factors
- **Homework Assignments:**
  §2.4 7, 9, 14, 32
  §2.5 3, 22
  §2.6 1, 5, 7, 11, 12, 18, 21, 25

Weak 4: January 28 – February 1.

- Numerical Approximations: Euler's Method. MATLAB commands for Euler's method.

- Linear Equations with Constant Coefficients. Review, emphasizing the consequences of linearity: the hom sol'ns form a two-dim'l space, nonhom and hom are related in a definite way.
- Variation of Parameters.
- The notion of Wronskian
- **Homework Assignments:**
  §2.7 1, 7, 12, 15
  §3.1 6, 7, 11, 16, 28
  §3.4 17, 18, 31
  §3.5 23, 28, 33, 38, 39
  §3.7 3, 5, 8, 15, 18

Weak 5: February 4 – 8.

- Euler equations.
- Definition of the Laplace Transform.
- Solution of Initial Value Problems. Review of partial fractions decomposition.
- Step Functions.
- **Homework Assignments:**
  §5.5 1, 6, 18, 19, 23, 24
  §6.1 2, 3, 5, 6, 9, 19, 20
  §6.2 1, 2, 3, 8, 9, 13, 14, 16
  §6.3 1, 4, 6, 8, 10, 11, 15, 16, 19, 20, 27, 29, 31

Weak 6: February 11 – 15.

- Discontinous Forcing. Example: switches in electrical circuits.
- Impulse Functions. Discuss hammers and solid mechanics.
- The Convolution Integral.
- **Homework Assignments:**
  §6.4 3, 5, 9, 12
  §6.5 1, 4, 9, 12, 13, 17
  §6.6 1, 6, 9, 11, 13, 14

Weak 7: February 18 – 22.

- Two-Point Boundary Value Problems.
- **Homework Assignments:**
  §10.1 2, 3, 7, 14, 17, 20
- **First exam Friday, February 22**. Covers material through **§6.6**

Weak 8: February 25 – 29.

- Fourier Series.
- Fourier Convergence Theorem. Periodic continuation. Gibbs' phenomenon.

- Even and Odd Functions.
- **Homework Assignments:**
  §10.2 4, 6, 8, 9, 16, 18, 29
  §10.3 2, 4, 13, 14, 15, 17
  §10.4 3, 5, 6, 7, 12, 16, 17, 35, 36

Weak 9: March 3 – 7.

- Separation of Variables: Heat Conduction in a Rod. Homogeneous partial differential equations with homogeneous boundary conditions.
- Other Heat Conduction Problems. Boundary-value problem for the steady state.
- **Homework Assignments:**
  §10.5 3, 4, 7, 11, 12, 22
  §10.6 2, 8, 11, 12, 15

Spring break: March 9 – 16.

Weak 10: March 17 – 21.

- The Wave Equation: Vibrations of an Elastic String.
- Laplace's equation.
- The Occurrence of Two-Point Boundary Value Problems.
- **Homework Assignments:**
  §10.7 4, 8, 10
  §10.8 2, 7, 8, 10
  §11.1 2, 3, 4, 5, 8, 10, 19

Weak 11: March 24 – 28.

- Sturm-Liouville Boundary Value Problems. Self-adjoint operator. Inner product spaces.
- Nonhomogeneous Boundary Value Problems.
- **Homework Assignments:**
  §11.2 1, 4, 7, 8, 11, 13, 14, 15, 27
  §11.3 2, 4, 7, 10, 22

Weak 12: March 31 – April 4.

- Vibrations of a Circular Membrane
- **Homework Assignments:**
  §11.5 1(a-b).
- **First exam Friday, April 4**. Covers material through **§11.3**

Weak 13: April 7 – 11.

- Review of Power Series: the geometric series and exponential series.
- Series Solutions Near an Ordinary Point.

- **Homework Assignments:**
  §5.1 1, 5, 8, 12, 13, 14, 18, 19, 21, 25
  §5.2 2, 10, 15, 23
  §5.3 3, 8, 11, 15, 22, 23, 24

Weak 14: April 14 – 18.

- Series Solutions Near a Regular Singular Point
- Bessel's Equation
- **Homework Assignments:**
  §5.6 3, 7, 8, 11, 14, 16
  §5.7 1, 4, 14, 18
  §5.8 1, 5, 7

Weak 15: April 21

- Review

Block Final Exam: Friday, May 2, 2:00–5:00 PM