



## **Ordinary Differential Equations**

**Spring Semester**

### **LECTURER**

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### **COURSE DESCRIPTION**

#### **COURSE TOPICS**

Week 1: Examples from mechanics and electricity of problems involving initial or boundary conditions. First order equations, the existence and uniqueness theorem.

Week 2: Second order linear equations; homogeneous equations and linear independence, the wronskian and lowering the order of an equation, homogeneous equations with constant coefficients.

Week 3: Separation to a homogeneous and an inhomogeneous problem, the method of undetermined coefficients and the method of variation of parameters.

Week 4: One sided Green's function for solving initial value problems.

Week 5: Reaction to constraints and to initial/boundary conditions.

Week 6: Generalization to  $n$ th order equations, the case of constant coefficients.

Week 7: Euler's formula, series solutions (Frobenius method), Bessel's function, Legendre's function, Hermite's function, Laguerre's function, regular and singular solutions.

Week 8: The Laplace Transform and its applications for solving differential equations, initial and final value theorems, transforms of convolutions.

Week 9: System of first order linear equations.

Week 10: Sturm-Liouville and self-adjoint problems, eigenfunctions and eigenvalues, oscillation of inhomogeneous equations by expansion in eigenfunctions in  $L_2(\mathbb{R})$ , uniform convergence of the expansion, the example of Fourier series.

### **ASSIGNMENTS**

Students must submit at least 70% of the given homework assignments.

### **MIDTERM COURSE POLICY**

A midterm exam will be scheduled in the beginning of the semester. During an examination, student shall not use books, papers, or other materials not authorized by the instructor. The midterm count for 15% of the final grade.



### **FINAL COURSE POLICY**

The final exam will cover the entire course material and will count for 85% of the total course grade. The duration will be 3 hours. During an examination, student shall not use books, papers, or other materials not authorized by the instructor.

Students will have a first exam, Moed A. If the student does not pass, they can retake the exam, Moed B. The last exam taken will be the student's final grade for the exam.

### **REQUIRED READING**

Boyce W. and R.D. Prima: *Elementary differential equations and boundary value problems*, Wiley, last edition

### **ADDITIONAL READING**

There is no additional reading for this course