

SYLLABUS FOR MATH 255

(This syllabus will be updated and adjusted to reflect the pace of the course; please check it regularly.)

Purpose of the course The course is an introduction to the most basic concepts and methods in solving ordinary differential equations. Upon completion of this course students should know some applications of ordinary differential equations in engineering, physics and biology.

Text book: Elementary differential equations and boundary value Problems, by W.E.Boyce and R.C. DiPrima, (7th edition red cover custom version)

Ch 1 Introduction:

- 1.1 Some basic mathematical models ; direction fields,
 - 1.2 Solutions of some differential equations,
 - 1.3 Classification of differential equations.
- (2 lecture)

Ch 2. First Order Differential Equations:

- 2.1 Linear Equations with variable coefficients,
 - 2.2 Separable equations,
 - 2.3 Only Example 4 (Escape velocity)
 - 2.4 Difference between linear and nonlinear equations,
 - 2.5 Autonomous equations and Population Dynamics,
 - 2.6 Exact equations and integrating factors,
 - 2.7 Numerical approximation, Euler Method,
 - 2.8 The existence and uniqueness theorem.
- (7 lectures)

Ch 3 Second order Linear equations:

- 3.1 Homogeneous equations with constant coefficients,
 - 3.2 Fundamental solutions of linear homogenous equations,
 - 3.3 Linear independence and the Wronskian,
 - 3.4 Complex roots of the characteristic equations,
 - 3.5 Repeated roots, reduction of the order,
 - 3.6 Nonhomogeneous equations, Method of undetermined coefficients,
 - 3.7 Variation of parameters.
- (5 lectures)

MIDTERM 1, most likely Oct 26

Ch 4 Higher Order Linear Equations:

- 4.1 General theory of n -th order linear equations,
 - 4.2 Homogeneous equations with constant coefficients,
 - 4.3 The method of undetermined coefficients,
 - 4.4 The method of variation of parameters.
- (4 lectures)

Ch 5. Series Solutions of Second order linear equations:

- 5.1 Review of power series,
- 5.2 Series solutions near ordinary point (part 1),
- 5.3 Series solutions near ordinary point (part 2),
- 5.4 Regular singular points,
- 5.5 Euler equations,
- 5.6 Series solutions near regular singular point (part 1),
(3 lectures)

MIDTERM II, Nov 23

Ch 6 The Laplace Transform:

- 6.1 Definition of the Laplace transform,
- 6.2 Solution of the initial value problems,
- 6.3 Step functions,
- 6.4 Differential equations with discontinuous forcing,
- 6.5 Functions,
- 6.6 Impulse functions,
- 6.6 The convolution integral.
(5 lectures)

FINAL EXAM, Thursday DEC 10, 11.30-1.18 PM

bf. Home work assignments

- 1.1: 1,3,4, 18(difficult),
- 1.2: 1,3,6,7,10,13
- 1.3: 1, 4, 6, 7,9,14, 21,23, 25,27
- 2.1: 6,7,10,11 (only c), 13,15,17, 21,23,27, 37
- 2.2: 2,5,6,8, 13,17, 22, 26, 28. 31, 35
- 2.3: 21, 25, 26(without (b)), 26
- 2.4: all odd problems from 1 to 12, 21, 27, 29, 31
- 2.5: 1,3,5, 9,13, 15
- 2.6: 3, 7, 12, 15, 17, 19, 21, 25, 27, 1, 32
- 2.7: (decided in recitation class; most of the problems in this section require
extensive numerical calculations)
- 2.8: 1, 2, 3, 11, 15-17
- 3.1: 5, 7, 19, 20, 22, 26, 28, 30, 32, 34, 38, 40, 42
- 3.2: 2, 5, 10, 12, 17, 23, 25, 28, 30, 33, 35
- 3.3: 1, 6, 10, 12, 13, 15, 16, 21, 23, 27
- 3.4: 7, 11, 15, 20, 23, 25, 26
- 3.5: 7, 9, 11, 13, 17, 19, 25, 27, 38, 40
- 3.6: 1, 5, 9, 11, 15, 16, 18, 21, 23,
- 3.7: 7,11, 14, 18, 28, 30, 32
- 4.1: 3,5,9,10, 15,16,17, 20,21,23, 26,28.
- 4.2: 11, 15, 19, 21, 25, 29, 31, 35, 37, 38
- 4.3: 5, 6, 7, 10, 12, 15, 17,
- 4.4: 3,5,7,10, 12 14,16
- 5.1 1, 2,7, 10, 13, 15, 19, 21

5.2 1, 7, 8, 12, 21, 26
5.3 1, 2, 5, 6, 7
5.4 1, 7, 9, 17,
5.5 3, 7, 10, 12, 17, 20, 21, 23
5.6 3, 7, 9 14, 15
5.7 1, 3, 14, 15, 20

Grading policy

Two meadterms each graded with 100 pts.

Final exam graded with 200 pts.

Home work assignment 50 pts.

Office hours 10.30-11.30 MWF

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