



King Saud University
Department of Mathematics
Syllabus of: MATH204, Second semester 1434/1435 H

Course code: MATH204

Course title: Differential Equations

Pre-Requisite: MATH203 or MATH200

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Text Book: Differential equations with boundary value problems (7th edition),
Dennis G. Zill and Michael R. Cullen

References:

- Fundamentals of Differential equations and value problems (4th edition)
By: Nagle Saff Snider

Course objectives

- 1- To provide basic concepts of differential equations.
- 2- To provide methods for solving some types of differential equations.
- 3- To introduce some applications of differential equations.

Course learning outcomes

Students completing this course successfully will be able to:

- Determine the region in which a first order initial values problem has a unique solution.
- Solve first order differential equations of type: Separable equations, exact equations, special integrating factors, substitution and transformation, linear differential equations with constants coefficients, Bernoulli's equation.
- Construct a second solution for a second order linear differential equation from a given solution.
- Solve homogeneous linear differential equations of higher orders with constant coefficients.
- Solve nonhomogeneous linear differential equations by using the method of undetermined coefficients.
- Solve nonhomogeneous linear differential equations by using the method of variation of parameters.
- Solve differential equations of Cauchy-Euler type.
- Find solutions of linear differential equations in power series form about an ordinary point.
- Solve a system of linear differential equations with constant coefficients by elimination method.
- Find the Fourier series for a given function
- Find the Fourier integral for a given function

Course contents

Week #	Date	Topics	Contact hours (Lectures+Tutorials)
1	January 26-30	Definition of a Diff Eq., Classification of Diff Eqs. by (type, order, linearity), Interval of definition, Types of Solutions (explicit, implicit).	3+2
2	February 2-6	Initial value problems. Existence and uniqueness theorem, Separable equations.	3+2
3	February 9-13	Linear equations, Exact Equations, Integrating factor.	3+2
4	February 16-20	Solutions by substitution: Homogeneous equations.	3+2
5	February 23-27	Bernoulli's equation, First order differential equations with linear coefficients	3+2
6	March 1-5	Linear Models: Growth and decay, Newton's Law of Cooling/ Heating	3+2
7	March 8-12	Higher order Linear Diff Eqs: Existence-Uniqueness theorem, Linearly (independent, dependent), Wronskian of functions, Reduction of order	3+2
8	March 15-19	Homogeneous linear equations with constant coefficients.	3+2
		Midterm Vacation	
8	March 22-26	Undetermined coefficient method, Superposition principle.	
9	March 30 -April 3	Variation of parameters, Cauchy-Euler Equation.	3+2
10	April 6-10	Solving systems of Linear Equations by Elimination.	3+2
11	April 13-17	Series solutions of Linear Equations.	3+2
12	April 20-24	Orthogonal Functions and Fourier Series.	3+2
13	April 27-May 2	Fourier cosine and sine series, Complex Fourier Series	3+2
14	May 5-9	Fourier Integral.	3+2
15	May 12-16	Review	3+2
16		Final Exam	3+0

Homework assignments:

Chapter	Section	Exercices
1	1.1	1, 2, 3, 4, 7, 10, 13, 17, 25
2	2.1	2, 5, 8, 10, 17, 19
	2.2	2,5, 12, 14, 16, 19, 33, 40, 47, 50, 58, 59, 61
	2.3	11, 19, 20, 24, 25, 27, 33, 40
	2.4	5, 9, 17, 29, 31, 38
	2.5	4, 6, 11, 17, 28, 42, 49
	2.6	1, 3, 5, 10
3	3.1	11, 13, 20, 27
	3.2	1, 2, 3, 4, 5, 6, 7, 12, 13, 14
4	4.1	1, 5, 9, 15, 16, 17, 19, 20, 23, 27, 28, 30, 33, 37, 38, 39, 41, 42
	4.2	3, 6, 13, 19, 21, 31, 32, 33
	4.3	3, 5, 8, 21, 24, 25, 31, 33,37, 42, 57, 58, 60, 61, 63
	4.4	1, 5, 7, 10, 15, 17, 19, 21, 24, 29, 32,38
	4.7	1, 4, 9, 15, 17, 21
6	6.1	5, 13, 18, 21, 26, 34, 36, 43
	6.3	3, 9, 10, 14, 15, 23
8	8.1	2, 3, 5, 10, 13, 20, 21, 23
11	11.1	1, 3, 6, 8, 9, 12, 16, 17, 18
	11.2	3, 5, 7, 17, 19
	11.3	11, 13, 19, 23, 32, 36
14	14.3	2, 3, 7, 9, 15, 19

Grading

First midterm 25%

Second midterm 25%.

Homework assignments 2%

Quizzes 8%.

Final Exam 40%

Total 100%

Useful Online Material

1. Paul's Online Math Notes Differential Equations

<http://tutorial.math.lamar.edu/classes/de/de.aspx>

2. SOS Differential Equations

<http://www.sosmath.com/diffeq/diffeq.html>

3. Wikipedia, the free encyclopedia

http://en.wikipedia.org/wiki/Ordinary_differential_equation

4. Lectures on Differential Equations (Video MIT)

<http://ocw.mit.edu/OcwWeb/Mathematics/18-03Spring-2006/VideoLectures/index.htm>

5. <http://eqworld.ipmnet.ru/index.htm>