



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

Course code: MATH204

Course title: Differential Equations

Pre-Requisite: MATH203 or MATH200

**Instructor:** Dr. Saleem Obaidat

Room 2A123, Building 4, Mathematics Department.

E-mail: [saleem@ksu.edu.sa](mailto:saleem@ksu.edu.sa)

Website: <http://fac.ksu.edu.sa/saleem/home>

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

**References:**

- Fundamentals of Differential equations and value problems (4<sup>th</sup> 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	September 1-5	Definition of a Diff Eq., Classification of Diff Eqs. by (type, order, linearity) , Interval of definition, Types of Solutions (explicit, implicit).	3+2
2	September 8-12	Initial value problems. Existence and uniqueness theorem, Separable equations.	3+2
3	September 15-19	Linear equations, Exact Equations, Integrating factor.	3+2
4	September 22-26	Solutions by substitution: Homogeneous equations.	3+2
5	Sep. 29- Oct. 3	Bernoulli's equation, First order differential equations with linear coefficients	3+2
6	October 6-9	Linear Models: Growth and decay, Newton's Law of Cooling/ Heating	3+2
		<b>Hajj Vacation</b>	
7	October 21-24	Higher order Linear Diff Eqs: Existence-Uniqueness theorem, Linearly (independent, dependent), Wronskian of functions, Reduction of order	3+2
8	October 28-31	Homogeneous linear equations with constant coefficients.	3+2
8	November 3-7	Undetermined coefficient method, Superposition principle.	3+2
9	November 10-14	Variation of parameters, Cauchy-Euler Equation.	3+2
10	November 17-21	Solving systems of Linear Equations by Elimination.	3+2
11	November 24-28	Series solutions of Linear Equations.	3+2
12	December 1-5	Orthogonal Functions and Fourier Series.	3+2
13	8-13	Fourier cosine and sine series, Complex Fourier Series.	3+2
14	15-20	Fourier Integral.	3+2
15	22-27	Review	3+0
16		<b>Final Exam</b>	

## 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](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>