

King Fahd University of Petroleum and Minerals  
Department of Mathematics and Statistics  
**SYLLABUS**  
**MATH 202 (171)**  
Coordinator: Dr. Ahmad Al-Dweik

**Title:** Elements of Differential Equations.

**Credit:** 3-0-3

**Textbook:** A First Course in Differential Equations by D.G. Zill, 10<sup>th</sup> Edition.

**Description:** First-order and first-degree differential equations. Linear Models. Homogeneous differential equations with constant coefficients. Undetermined coefficients-Annihilator Approach, reduction of order, variation of parameters, and Cauchy-Euler equation. Series solutions. Systems of linear differential equations.

**Learning Outcomes:**

At the end of this subject, students should be able to:

- 1) Understand some basic definitions and terminology associated with differential equations and their solutions.
- 2) Determine a region in which a first-order initial-value problem has a unique solution.
- 3) Identify and solve first-order differential equations of type: Separable, Linear, Exact, Homogeneous, and of Bernoulli's type.
- 4) Solve some real-life linear models.
- 5) Find solutions to initial-value and boundary-value problems from a given family of solutions.
- 6) Understand the superposition principals for linear higher-order homogeneous or nonhomogeneous differential equations.
- 7) Understand the meaning of a Fundamental Set of Solutions of a higher-order linear homogenous differential equation.
- 8) Apply the method of Reduction of Order to homogeneous linear second-order differential equations.
- 9) Determine the general solution of homogeneous linear nth-order differential equations with real constant coefficient.
- 10) Use the method of Undetermined Coefficients-Annihilator Approach to find a particular solution of a nonhomogeneous nth-order differential equation with real constant coefficients.
- 11) Use the method of Variation of Parameters to find a particular solution of a second-order linear nonhomogeneous differential equation.
- 12) Solve a Cauchy -Euler Equation.
- 13) Find Power Series solutions of linear second-order differential equations about ordinary points.
- 14) Find Series solutions of linear second-order differential equations about regular singular points.
- 15) Find the Eigenvalues and the Eigenvectors of a square matrix.
- 16) Solve systems of linear homogeneous or nonhomogeneous differential equations using matrix techniques and eigenvalues.
- 17) Use a Matrix Exponential as a Fundamental Matrix of a linear system of differential equations.

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Week	Date	Sec.	Topics	Suggested Homework Problems
1	Sep 17 – 21	1.1	Definition and Terminology	2, 4, 10, 14, 18, 20, 22, 24, 30, 32, 34, 38
		1.2	Initial-Value Problems	2, 4, 10, 14, 18, 22, 24, 28, 30
<b>National Day Holiday on 24 September</b>				
2	Sep 25 – 28	2.2	Separable Variables	8, 10, 12, 13, 20, 22, 24, 28, 30
		2.3	Linear Equations	6, 12, 14, 18, 20, 24, 28, 30, 32
3	Oct 01 – 05	2.4	Exact Equations	4, 6, 8, 15, 18, 26, 28, 30, 33, 36, 42(a), 43
		2.5	Solutions by Substitutions	2, 6, 8, 10, 12, 14, 18, 20, 22, 27, 28, 30
4	Oct 07* – 12	2.5	Continuation	
		3.1	Linear Models: Growth and Decay, Newton's Law of Cooling	4, 8, 10, 15, 16, 18, 20
5	Oct 15 – 19	4.1.1	Initial-Value and Boundary-Value Problems	2,4,6, 10, 12,13(c) , 14(d)
		4.1.2	Homogeneous Equations	16, 22, 24,25, 28, 30
<b>EXAM I: Thursday, Oct. 19th (5:45-7:45 PM), Material 1.1-3.1</b>				
6	Oct 22 – 26	4.1.3	Nonhomogeneous Equations	31,34,36(b, c)
		4.2	Reduction of Order	2, 4, 8, 12, 14, 19, 20
7	Oct 29 – Nov 02	4.3	Homogeneous Linear Equations with Constant Coefficients	6, 8, 10, 14, 18, 20, 26, 30, 34, 36, 40, 49, 50, 51
		4.5	Undetermined Coefficients – Annihilator Approach	6, 8, 12, 14, 22, 24, 26, 30, 32, 34, 40, 44, 48, 52, 60, 62, 68, 72
8	Nov 05 – 09	4.5	Continuation	
		4.6	Variation of Parameters	4, 6, 10, 12, 14, 18, 20, 24, 26, 28
9	Nov 12 – 16	4.7	Cauchy-Euler Equation (Both Methods)	4, 8, 14, 16, 18, 20, 24, 28, 32, 34, 38, 39
		6.1	Review of Power Series	2,3, 4, 8, 10, 12, 16
10	Nov 19 – 23	6.2	Solutions about Ordinary Points	2,4,11,12,16,21,22
<b>EXAM II: Thursday, Nov. 23th (5:45-7:45 PM), Material 4.1.1-4.7</b>				
11	Nov 26 – 30	6.3	Solutions about Singular Points	1,4,8,12,14,16,19,24,30,32
		App II.1, App II.2	Matrices and Linear Systems (review)	12, 18, 22, 23, 26, 30(d, g), 36, 40, 44
12	Dec 03 – 07	App II.3	The Eigenvalue Problem	48, 49, 53, 54, 56, 59, 60, 61
		8.1	Preliminary Theory-Linear System	3, 6, 8, 10, 14, 15, 16, 19, 22, 24, 26
13	Dec 10 – 14	8.2	Homogeneous Linear Systems	
		8.2.1	Distinct Real Eigenvalues	4, 8, 10, 13, 14
		8.2.2	Repeated Eigenvalues	20, 22, 24, 26, 27, 28, 30
14	Dec 17 – 21	8.2.3	Complex Eigenvalues	33, 34, 36, 39, 40, 42, 45
		8.3.2	Variation of Parameters	12, 14, 15, 28, 30, 31
15	Dec 24 – 28	8.4	Matrix Exponential (No Laplace Transform) Review	1, 4, 5, 6, 8, 9, 10, 12
<b>Final Exam: Monday, January 1, 2018 (8:00-11:00 AM), Material: Comprehensive.</b>				

**Important Dates:**

**07 OCT**  
**28 SEP**  
**26 OCT**  
**23 NOV**

\*Normal Sunday Class

Last day for dropping course(s) without permanent record

Last day for dropping course(s) with grade of "W"

Last day for withdrawal from all courses with grade of "W"

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**Exam Questions:**

The questions of the common exams based on the examples, homework problems and the exercises of the textbook.

**Missing Exam I or Exam II:**

No makeup exam will be given under any circumstance. When a student misses Exam I or Exam II for a legitimate reason (such as medical emergencies), his grade for this exam will be determined based on the existing formula that depends on his performance in the non-missed exam and in the final exam.

**Attendance:**

Attendance is a University Requirement. A DN grade will be awarded to any student who accumulates 9 unexcused absences. Only official excuses are accepted.

**Academic Integrity:** All KFUPM policies regarding ethics apply to this course.

**Grading Policy:**

1. **Exam I: 25%**
2. **Exam II: 25%**
3. **Final Exam 35%**
4. **Classwork: 15%**

The average ( $x$  out of 60) of the Class Work of the sections taught by the same instructor should be in the interval  $[42, 45]$ .

**Passing Grade: According to department policy, the passing grade is 50%.**

\*\*\*\*\*Best Wishes for a Pleasant Semester\*\*\*\*\*