

KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

Department of Mathematics & Statistics

MATH 208 Course Syllabus

Term 173

Instructor: **Dr. A. Laradji**

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Course Code : MATH 208

Course Title : Introduction to Differential Equations and Linear Algebra

Credits : 3-0-3

Textbook : Differential Equations and Linear Algebra, C.H. Edwards and D.E. Penny, Prentice Hall, Third Edition (2014)

Objectives : The course introduces elementary differential equations and linear algebra to students of Computer Science, Computer Engineering, System Engineering and Earth Science.

Learning Outcomes:

Upon successful completion of this course, students should be able to:

- Solve **systems of linear algebraic equations** by **elimination of variables**.
- Write **systems of linear equations** in the form of matrices and **solve** them by **performing elementary row operations**.
- Find **inverse and eigenvalues & eigenvectors** of matrices.
- Clearly understand **vector spaces, subspaces, bases** and their **dimensions**.
- Apply **eigenvalues and eigenvectors** to **diagonalize matrices** and construct **block diagonal** and **Jordan forms for matrices** where eigenvalues have incomplete multiplicity.
- Recognize and solve **linear first order, separable** and **exact differential equations** and apply them to **mixture, growth** and **decay problems**.
- Solve **homogeneous differential equations** with **constant coefficients**.
- Apply **Wronskian** to determine **linear independence/dependence of solutions of differential equations**.
- Apply **methods of undetermined coefficients** and **variation of parameters** to solve **non-homogeneous differential equations**.
- Write **systems of differential equations** in matrix form and solve them by applying the **method of eigenvalues and eigenvectors**.

Week	Date	Section	Topic	Suggested Homework
1	Jun 24 – 30 (Saturday, June 30 is a Normal Monday Class)	1.1	Differential Equations & Mathematical Models (Only Growth & Decay)	2, 6, 10, 14, 20, 35, 38
		1.2	Integrals as General & Particular Solutions	2, 4, 6, 8, 11, 17
		1.4	Separable Equations (Without Applications)	2, 8, 10, 24, 26, 34, 40
		1.5	First-Order Linear Equations	2, 8, 10, 21, 28, 32
		1.6	Substitution Methods & Exact Equations (Only Exact Eqs)	32, 36, 40, 42
2	Jul 1 – 5	3.1-3.6	Review Only: Linear Systems, Matrices & Gaussian Elimination, Reduced Row-Echelon Form, Matrix Operations, Inverse Matrices, Determinants, Inverse & Adjoint Matrix	Sec 3.1: 4, 13, 18, 24, 28 Sec 3.2: 2, 10, 15, 28 Sec 3.3: 2, 6, 10, 26, 28 Sec 3.4: 1, 10, 14, 25 Sec 3.5: 3, 8, 23 Sec 3.6: 2, 7, 17, 21, 33, 38
3	Jul 8 – 12	4.1	The Vector Space \mathbb{R}^3	1, 4, 6, 8, 10, 16, 19, 20
		4.2	The Vector Space \mathbb{R}^n & Subspaces	2, 8, 12, 14, 17, 26
		4.3	Linear Combination & Independence of Vectors	2, 6, 12, 17, 25
		4.4	Bases & Dimension for Vector Spaces	2, 9, 12, 13, 16, 23
First Major Exam: Thursday, July 12, 2018 (Material to be covered Sections 1.1 – 4.2)				
4	Jul 15 – 19	4.5	Row and Column Spaces (Rank of Matrices Only)	Compute only the rank of matrices in Problems 1, 4, 8, 12
		5.1	Introduction: Second Order Linear Equations	2, 10, 15, 19, 26, 28, 43
		5.2	General Solutions of Linear Equations	3, 9, 14, 22, 26
		5.3	Homogeneous Equations with Constant Coefficients	3, 4, 14, 19, 22, 28, 31, 33, 39
5	Jul 22 – 26	5.5	Nonhomogeneous Equations: Methods of Undetermined Coefficients and Variation of Parameters	1, 4, 8, 16, 21, 27, 42, 44, 48, 52, 57, 58, 62
		6.1	Introduction to Eigenvalues	3, 7, 14, 25, 31
		6.2	Diagonalization of Matrices	2, 10, 15, 18, 27
Second Major Exam: Thursday, July 26, 2018 (Material to be covered Sections 4.3 – 5.5)				
6	Jul 29 – Aug 2	6.3	Only Cayley-Hamilton Theorem	2, 5, 18, 22
		7.1	First Order Systems & Applications	1, 3, 8, 14, 20, 21
		7.2	Matrices & Linear Systems	1, 6, 12, 16, 20, 24
		7.3	The Eigenvalue Method for Linear Systems	1, 3, 9, 18, 25, 26
7	Aug 5 – 9	7.5	Multiple Eigenvalue Solutions & Jordan Form	4, 9, 13, 16, 25, 28, 31, 38, 40, 43
		8.1	Matrix Exponentials & Linear Systems	2, 6, 10, 24, 26
		8.2	Nonhomogeneous Linear Systems (Only Variation of Parameters method)	17, 19, 26, 32
8	Aug 12	8.2	Nonhomogeneous Linear Systems - Continued	