

# KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

Department of Mathematics & Statistics

## Math260 Course Syllabus

Term – 171

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**Course Title** : Math260 (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, a student 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 **method of eigenvalues and eigenvectors**.

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Week	Date	Section	Topic	Suggested Homework
1	Sep. 17 – 21	1.1	Differential Equations & Math. Models (Only Decay & Growth)	2,6, 8,10,14,20,35,38
		1.2	Integrals as General & Particular Solutions	2, 4, 6, 8, 11, 17
<b>24 September:</b>		<b>National Day Holiday</b>		
2	Sep. 26 – 28	1.4 1.5	Separable Equations (Without Applications) Linear First Order Eqs.	2, 8, 10, 24, 26, 34,40
3	Oct. 01 – 05	1.5 1.6	Linear First-Order Eqs. (cont.) Substitution Methods & Exact Eqs. - <b>Only Exact Eqs</b>	2, 8, 10, 21, 28, 32
4	Oct. 07* – 12	1.6	Substitution Methods & Exact Eqs - <b>Only Exact Eqs.</b> <b>Review only</b>	32, 36, 40, 42
		3.1-3.6	Linear Systems, Matrices & Gaussian Elimination, Reduced Row-Echelon Form, Matrix Operations, Inverse Matrices, Determinants	<b>Sec 3.1:</b> 4, 13, 18, 24, 28 <b>Sec 3.2:</b> 2, 10, 15, 28 <b>Sec 3.3:</b> 2, 6, 10, 26, 28 <b>Sec 3.4:</b> 1, 10, 14, 25 <b>Sec 3.5:</b> 3, 8, 23 <b>Sec 3.6:</b> 2,7,17,21
5	Oct. 15 – 19	3.6	Inverse & the Adjoint Matrix	33, 38
		4.1	The Vector Space $\mathbb{R}^3$	1, 4, 6, 8, 10, 16, 19, 20
		4.2 4.3	The Vector Space $\mathbb{R}^n$ & Subspaces Linear Combination & Independence of vectors	2, 8, 12, 14, 17, 26 2, 6, 12, 17, 25
<b>First Major Exam:</b>		<b>October 19</b>		
6	Oct. 22 – 26	4.4	Bases & Dimension for vector spaces	2, 9, 12, 13, 16, 23
		4.5	Row & Column Spaces ( <b>Rank of Matrices only</b> )	1,4,8,12,14,16
		5.1	Introduction : Second Order Linear Equations	2, 10, 15, 19, 26, 28, 43
7	Oct.29 – Nov.02	5.2	General solutions of Linear Eqs.	3, 9, 14, 22, 26
		5.3	Homogeneous Eqs. with Constant Coefficients	3,4,14,19,22,28,31,33,39
8	Nov. 05 – 09	5.5 5.5	Nonhomogeneous Eqs. & Undetermined Coefficients Method of Variation of Parameters	1, 4, 8, 16, 21, 27, 42, 44 48, 52, 57, 58, 62
9	Nov. 12 – 16	7.1	First Order Systems & Applications	1,3,8,14,20,21
		7.2	Matrices & Linear Systems	1, 6, 12, 16, 20, 24
10	Nov. 19 – 23	6.1	Introduction to Eigenvalues	3, 7, 14, 25,31
		7.3	The Eigenvalue Method for Linear Systems	
<b>Second Major Exam:</b>		<b>November 23</b>		
11	Nov. 26 – 30	7.3	The Eigenvalue Method for Linear Systems - Continued	1, 3, 9, 18, 25, 26
		6.2	Diagonalization of Matrices	2, 10, 15, 18, 27
12	Dec. 03 – 07	6.3	<b>Only</b> The Caley Hamilton Theorem	2, 15, 18, 22
		7.5	Multiple Eigenvalue Solutions	
13	Dec. 10 – 14	7.5	Multiple Eigenvalue Solutions (continued) Jordan Normal Form	4, 9, 13, 16, 25, 28, 31 38, 40, 43
		8.1	Matrix Exponentials & Linear Systems	2, 6, 10, 24, 26
14	Dec. 17 – 21	8.2	Nonhomogeneous Linear Systems ( <b>Only Variation of Parameters Method</b> )	
		8.2	Nonhomogeneous Linear Systems - Continued	17, 19, 26, 32
15	Dec. 24 – 28		Catch-up and Review	
<b>Final Exam:</b>		<b>January 07, 2018</b>		

### IMPORTANT DATES

<b>07* OCT</b>	Normal Sunday Class
<b>28 SEP</b>	Last day for dropping course(s) without permanent record
<b>26 OCT</b>	Last day for dropping course(s) with grade of "W"
<b>23 NOV</b>	Last day for withdrawal from all courses with grade of "W"