

MATH-UA 2034

Linear Algebra & Differential Equations

NYU London

Instructor Information

- TBA
- Office hour and location: TBC

Course Information

- Mon 4.30 – 6.00 and Wednesday 4.30 – 6.00
 - Class room number G01
- Prerequisite: You should have a good command of the concepts and methods in Calculus, as covered in MA-UY 914, MA-UY 1024/1034 and MA-UY 1124/1424

Course Overview and Goals

Linear algebra and differential equations are central to modern mathematics and engineering. The concepts in linear algebra have the power to explain fundamental principles and simplify calculations in engineering, computer science, mathematics, physics, biology, statistics, digital media and economics. In this course you will learn the basic concepts and skills of linear algebra that are needed for later math courses, such as differential equations, multivariable calculus, and by other courses needed for your major. The course combines abstract thinking with elementary calculations. The abstract concepts you will learn in linear algebra are as important as the computations. Differential equations play an important role in modeling virtually every physical, technical, or biological process, from celestial motion to aerospace design, from bridge design to animation, from financial trends to the interactions between neurons. This course is an introduction to the field of differential equations and will include the study of the fundamental concepts and techniques for the analytic and numeric solutions of ordinary differential equations, as well as classic applications.

Upon Completion of this Course, students will be able to:

- Formulate, solve, apply, and interpret systems of linear equations in several variables using Gaussian elimination;
- Know the properties of matrices and apply them to the solutions of systems of linear equations;
- Understand the notions of vector spaces and basis, and apply this understanding to the solution of problems;
- Develop an understanding of linear transformations and be able to apply that knowledge;
- Calculate eigenvalues and eigenvectors, and be able to use them in context.

- Model and solve first order differential equations;
- Solve higher order linear ordinary differential equations and initial value problems;
- Solve a linear system of first order differential equations with constant coefficients;
- Be familiar with elementary concepts of numerical analysis, especially numerical solutions of initial value problems for ordinary differential equations;
- Formulate, solve, apply, and interpret systems of linear equations in several variables.

Course Requirements

Grading of Assignments

The grade for this course will be determined according to these assessment components:

Assignments/ Activities	Description of Assignment	% of Final Grade	Due
Weekly coursework	Exercises to be done away from class and handed in a week later	20%	At each class a week later
Mid-term exam 1	1 hour in-class test	15%	
Mid-term exam 2	1 hour in-class test	15%	
Final exam	Final exam	50%	

Failure to submit or fulfill any required course component results in failure of the class

Grades

Letter grades for the entire course will be assigned as follows:

Letter Grade	Percent	Description
A/A-	90 - 100%	Good understanding of ideas: ability to model and to solve problems correctly and efficiently.
B-/B/B+	80 - 89%	Reasonable understanding of ideas: some ability to model and the ability to solve problems reasonably well
C-/C/C+	70 - 79%	Some understanding of ideas and ability to solve problems with some degree of success
D/D+	65 – 69%	Ability to solve standard problems with some degree of success

Letter Grade	Percent	Description
F	0 – 64%	Ideas not understood and inability solve problems

Course Materials

Required Textbooks & Materials

Worldwide Differential Equations with Linear Algebra by Robert McOwen.
Center of Math, 2015. ISBN: 978-0-9842017-2-1 v. 0603162120
You can purchase a copy Digital \$14.95 / Print \$39.95
<http://www.centerofmathematics.com/wwcomstore/index.php/diffeqns.html>

Optional Textbooks & Materials

- Linear Algebra and its Applications, 4th Edition by David C Lay. Addison Wesley, 2012. ISBN-13: 978-0-321-38517-8.
- A First Course in Differential Equations by Dennis Zill Brooks/Cole/Cengage ISBN-13:978-0-495-10824-5.

Resources

- **Access your course materials:** [NYU Classes](http://nyu.edu/its/classes) (nyu.edu/its/classes)
- **Databases, journal articles, and more:** [Bobst Library](http://library.nyu.edu) (library.nyu.edu)
- **NYUL Library Collection:** [Senate House Library](http://catalogue.libraries.london.ac.uk) (catalogue.libraries.london.ac.uk)
- **Assistance with strengthening your writing:** [NYU Writing Center](http://nyu.mywconline.com) (nyu.mywconline.com)
- **Obtain 24/7 technology assistance:** [IT Help Desk](http://nyu.edu/it/servicedesk) (nyu.edu/it/servicedesk)

Course Schedule

Session/Date	Topic	Reading	Assignment Due
<i>First two weeks are on first order ODEs (ordinary differential equations)</i>			
Session 1:	Differential equations and mathematical models/Geometric analysis and existence and uniqueness	Text by McOwen: Sections 1.1, 1.2	
Session 2:	Separable equations/Linear equations	1.3,1.4	CW 1: Feb 13
Session 3:	Other methods of solving first order ODEs	1.5	

Session/Date	Topic	Reading	Assignment Due
Session 4:	Population modelling/Numerical Methods	Material will be provided	CW 2: Feb 20
<i>Next two weeks are on second order ODEs</i>			
Session 5:	Intro to higher order ODEs/General solutions for second order linear ODEs, Homogeneous differential equations with constant coefficients	2.1,2.2,2.3	
Session 6:	Non-homogenous ODEs with constant coefficients	2.4	CW3: Feb 27
Session 7:	Non-homogenous ODEs – method of variation of parameters	Material will be provided	
Session 8:	Applications and Modelling	From Chap 2	CW 4: March 4
<i>Next two weeks are on the Laplace transform and then the first mid-term on material from lectures 1 – 11</i>			
Session 9:	Laplace transform and its inverse	3.1	
Session 10:	Transforms of derivatives and initial value problems	3.2	CW 5: March 13
Session 11:	Catch up and review		
Session 12:	First mid-term exam		
<i>Next five weeks or so on Linear algebra, including the second midterm on material from lectures 13 – 20</i>			
Session 13:	Introductions to Systems and Matrices/Gaussian Elimination	4.1,4.2	CW 6: March 20
Session 14:	Reduced Row-Echelon Form and Rank/Inverse of a Square Matrix	4.3,4.4	
Session 15:	Determinant of a Square Matrix/Cofactor Expansion	4.5,4.6	CW 7: March 27
Session 16:	Vector Spaces in \mathbb{R}^n /General Vector Spaces/Subspaces and Spanning Sets	5.1,5.2,5.3	
Session 17:	Linear Independence/Basis and Dimension	5.4,5.5	CW 8 April 3
Session 18:	Change of basis/ Row and column spaces	Material provided	
Session 19:	Linear transformations	6.1	

Session/Date	Topic	Reading	Assignment Due
Session 20:	Catch up and review		
Session 21:	Mid-term 2		
Break			
Session 22:	Introduction eigenvalues and eigenvectors	6.1	CW 9: May 1
Session 23:	Diagonalisation and similarity	6.2	
<i>Last three weeks or so are on systems of first order ODEs, ending with the final exam on all material covered during the course</i>			
Session 24:	Introduction to first order systems	7.1	
Session 25:	Theory of first order systems/Eigenvalue method	7.2,7.3	CW 10: May 8
Session 26:	Variation of parameters method	Material provided	
Session 27:	Applications		
Session 28:	Catch up and review		
Session 29:	Help class		
	Final exam (all material)		

Co-Curricular Activities

- n/a

Classroom Etiquette

- Please have mobiles off.

NYUL Academic Policies

Attendance and Tardiness

- Key information on NYU London's absence policy, how to report absences, and what kinds of absences can be excused can be found on our [website](http://www.nyu.edu/london/academics/attendance-policy.html) (<http://www.nyu.edu/london/academics/attendance-policy.html>)

Assignments, Plagiarism, and Late Work

- You can find details on these topics and more on this section of our NYUL [website](https://www.nyu.edu/london/academics/academic-policies.html) (<https://www.nyu.edu/london/academics/academic-policies.html>) and on [the Policies and Procedures section of the NYU website](https://www.nyu.edu/academics/studying-abroad/upperclassmen-semester-academic-year-study-away/academic-resources/policies-and-procedures.html) for students studying away at global sites (<https://www.nyu.edu/academics/studying-abroad/upperclassmen-semester-academic-year-study-away/academic-resources/policies-and-procedures.html>).

Classroom Conduct

Academic communities exist to facilitate the process of acquiring and exchanging knowledge and understanding, to enhance the personal and intellectual development of its members, and to advance the interests of society. Essential to this mission is that all members of the University Community are safe and free to engage in a civil process of teaching and learning through their experiences both inside and outside the classroom. Accordingly, no student should engage in any form of behaviour that interferes with the academic or educational process, compromises the personal safety or well-being of another, or disrupts the administration of University programs or services. Please refer to the [NYU Disruptive Student Behavior Policy](#) for examples of disruptive behavior and guidelines for response and enforcement.

Disability Disclosure Statement

Academic accommodations are available for students with disabilities. Please contact the Moses Center for Students with Disabilities (212-998-4980 or mosescsd@nyu.edu) for further information. Students who are requesting academic accommodations are advised to reach out to the Moses Center as early as possible in the semester for assistance.

Instructor Bio

Departmental Tutor and lecturer in the Mathematics Department at UCL. I currently teach first year algebra and Galois Theory to undergraduates at UCL. My research interests are in abstract algebra, in particular non-commutative ring theory.