Math 202: Differential Equations

Spring 2019/2020

Course description. The first part of the course is an introduction to vector calculus: curve parametrization, line integrals of functions and vector fields along curves, and Green's theorem; surface parametrization, integrals on oriented surfaces, Stokes' and the divergence theorem.
The second part of the course focuses on developing different tools in solving ordinary differential equations and initial value problems: first order ODEs, the superposition principle and linear higher order ODEs, Frobenius method, Laplace transform. Natural phenomena are modeled as differential equations. Scientists and engineers should be able to analyze these models as well as interpret their solutions.

Textbooks

[1] J. Hass, C. Heil, and M. Weir, *Thomas' Calculus*, 14th edition in SI Units, Pearson Education.

[2] D. Zill, *A First Course in Differential Equations with Modeling Applications*, 10th edition, Cengage Learning.

Course learning outcomes. At the end of the course, students are expected to be familiar with the following topics.

- Curve parametrization, and line integrals of continuous functions along smooth curves.
- Vector fields, and line integrals of continuous vector fields along smooth curves.
- Conservative fields, derivation of potential functions, and fundamental theorem of line integrals.
- Green's theorem in two dimensions.
- Surface parametrization, and surface integrals on smooth oriented surfaces.
- Stokes' and the divergence theorem.
- Existence and uniqueness of solutions of first order initial value problems.
- Identifying and solving separable, linear and exact equations.
- Substitution method.
- Theory of linear ODEs, linearly independent solutions, and the superposition principle.
- Reduction of order.
- Linear homogeneous equations with constant coefficients.
- Finding particular solutions of linear ODEs using undetermined coefficients or variation of parameters.
- The Cauchy-Euler equations, and change of variable method.
- Identifying ordinary and singular points of linear ODEs.
- Expressing the solutions in infinite series, and the Frobenius method.
- Laplace transform properties and applications to solve IVPs and systems of differential equations.

Course policies

- In case you miss quiz 1 or quiz 2 due to an unexpected emergency, you must contact your instructor as soon as possible with the proper documentations.
- AUB policies regarding incomplete grades will be followed. Students are also expected to be familiar with the university policies and student code of conduct.
- This is a coordinated course. However, you can ONLY attend the lecture you are registered in.

Exams and grading. The course grade will be determined from the maximum of the following three options

- Option 1: 25% Quiz 1 + 25% Quiz 2 + 50% Final.
- Option 2: 20% Maximum(Quiz 1, Quiz 2) + 15% Minimum(Quiz 1, Quiz 2) + 65% Final.
- Option 3: 35% Maximum(Quiz 1, Quiz 2) + 20% Mininum(Quiz 1, Quiz 2) + 45% Final.

Statement from the Accessible Education Office AUB strives to make learning experiences as accessible as possible. If you anticipate or experience academic barriers due to a disability (including mental health, chronic or temporary medical conditions), please inform the instructor immediately so that you can privately discuss options. In order to help establish reasonable accommodations and facilitate a smooth accommodation process, you are encouraged to contact the Accessible Education Office: accessibility@aub.edu.lb; +961-1-350000x3246; West Hall, 314.

Resources

- **Math clinic.** The department of mathematics provides a daily free math tutoring service organized by graduate students. Bliss 205, 5:00-6:30 p.m.
- **Moodle.** There will be a common moodle page where we will post handouts, problem sets, previous exams and announcements. The problem sets contain additional exercises that are recommended to solve AFTER going through the class material and after solving the following suggested practice problems.

Section	Practice Problems
Thomas' Calculus	
12.1	5, 8, 10, 12, 15, 16, 19, 22, 24, 25
12.3	1, 3, 4, 10, 15
15.1	1-9, 11, 13, 15, 16, 17, 19, 21, 23, 25, 26, 27, 28, 33, 35
15.2	1, 3, 4, 5, 7, 9, 13, 15, 17, 19, 23, 25, 29, 33, 37
15.3	3, 5, 6, 7, 9, 12-22, 25, 28, 31, 33, 38
15.4	1-5,7,8, 9, 17, 19, 21, 23, 24, 26, 33, 35
15.5	1, 3, 5, 13, 14, 15, 17, 20, 23
15.6	7, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39
15.7	1, 3, 5, 6, 7, 9, 13, 15, 17, 29
15.8	4, 9, 11, 13, 15, 22
Quiz 1: Saturday February 29, 1:30 p.m.	
A First Course in Differential Equations with Modeling Applications	
1.1	2, 3, 12, 13, 16, 17, 20, 22, 23, 25, 26, 27, 29, 37, 43, 56, 58
1.2	1, 3, 6, 7, 9, 12, 15, 17, 19, 20, 22, 24, 29, 30
2.2	3, 7, 8, 12, 14, 15, 17, 20, 22, 24, 26, 28, 30
2.3	3, 7, 10, 15, 16, 19, 20, 22, 24, 26, 28, 31, 33, 37
2.4	2, 3, 8, 9, 11, 12, 17, 18, 2, 22, 25-34, 38, 42(a),43
2.5	1, 8, 9, 13, 15, 16, 17, 20, 25, 26, 29, 30, 33, 35, 36
4.1	2, 3, 5, 7, 9, 10, 12, 13, 15, 17, 18, 19, 20, 25, 28, 31, 32, 35, 38, 39
4.2	1, 4, 5, 8, 9, 11, 13, 17, 19, 20
4.3	8, 13, 16, 17, 20, 22, 23, 26, 27, 30, 31, 32, 34, 36, 38, 42, 49, 50, 51, 59, 60
Quiz 2: Saturday March 21, 3:30 p.m.	
4.4	1, 5, 10, 15, 19, 21, 22, 25, 30, 35, 37, 38, 39, 41
4.6	1,2, 3, 6, 9, 13-15, 21-24, 26, 28
4.7	4, 7, 11, 14, 15, 17, 20, 22, 26, 28, 30, 32, 33, 34, 35, 36, 37
6.1	5, 6, 8, 12, 14, 15, 16, 18, 19, 23, 24, 25, 27, 30, 31, 36, 37
6.2	4, 5, 7, 10, 15, 19, 22, 23, 24, 26, 27, 28
6.3	1, 2, 3, 6, 7, 9, 11, 12, 14, 15, 16, 18, 23, 30, 31, 32
7.1	1, 5, 12, 3, 14, 15, 16, 17, 18, 23, 26, 27, 28, 29, 32, 33, 34, 35, 38, 40
7.2	3, 4, 9, 13, 15, 17, 20, 24, 29, 30, 31, 32, 34, 35, 36, 39, 40
7.3	3, 5, 8, 10, 15, 18, 19, 21, 25, 30, 31, 38, 39, 41, 45, 47, 48, 49, 50, 51, 53, 56, 59, 63, 67, 70
7.4	4, 6, 9, 11, 13, 19, 21, 25, 26, 28, 29, 31, 32, 33, 38, 40, 45, 46, 49, 52, 53, 59, 60
7.5	1-12
7.6	1, 2, 5, 7, 9, 10, 12
The final exam is comprehensive, date and location are announced by the Registrar's office.	