جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Vector Calculus & Differential Equations - AMCS 131

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	AMCS 131
Course Title	Vector Calculus & Differential Equations
Academic Semester	Fall
Academic Year	2019/2020
Semester Start Date	08/25/2019
Semester End Date	12/10/2019
Class Schedule (Days & Time)	02:30 PM - 04:00 PM | Sun Wed

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Maria Alexandra Gomes	Alexandra.Gomes@KAUST.EDU.SA	+966128080652		Available to students anytime I am in my office (building 1, 4th floor, office 4303, library side) or email for an appointment.

Teaching Assistant(s)

Name	Email
TBA	TBA

Course Information

Comprehensive Course Description	Review of single-variable calculus. Limits, continuity, derivatives, indefinite integrals. Techniques of integration (by parts, trigonometric substitutions, partial fractions). Definite integral and applications. Coordinates, vectors, dot and cross products, Vector functions and vector fields. Partial derivatives. Chain rule. Directional derivative and gradient. Curves (explicit, implicit and parametric forms, level curves). Velocity, acceleration, arc length and curvature. Surfaces (explicit, implicit and parametric forms, level surfaces). Line integrals and path independence. Double integrals over rectangular, polar and more general regions. Volumes and surface areas. Green's theorem. Surface integrals. Flux. Stokes theorem. Triple integrals in rectangular, cylindrical and spherical coordinates. The divergence theorem. Complex numbers. Arithmetic operations. Polar forms. Powers and Roots. Functions of a complex variable: Exponential, logarithmic, trigonometric, hyperbolic functions. Contour integral. The Cauchy-Goursat theorem. First-order ordinary differential equations. Initial-value problems and direction fields. Separable and exact ODE's. Linear equations. The method of variation of parameters and integrating factors. Second-order linear ordinary differential equations. Homogenenous and non-homogeneous ODE's. Particular solutions. The method of undetermined coefficients. The method of variation of parameters. Solving second-order ODE's via the Laplace transform.
Course Description from Program Guide	The course is concentrated mostly on Multivariate Calculus and basic ODEs and contains some necessary preliminaries from Single Variable Calculus and Complex Analysis.
Goals and Objectives	The aim of this course is to prepare students for AMCS 201 (Applied Mathematics I) and AMCS 202 (Applied Mathematics II). This AMCS131 course is concentrated mostly on multivariable calculus and basic ODE's and contains some necessary preliminaries from single-variable calculus and complex analysis.

Required Knowledge	Single-variable calculus, and elements of multivariable calculus. Basic concepts from the theory of ordinary differential equations, complex numbers and elementary linear algebra.
Reference Texts	Dennis G. Zill: Advanced Engineering Mathematics, 6th edition, 2016. Any other edition is also ok.
Method of evaluation	**40.00**% - Final exam **40.00**% - Quiz(zes) **20.00**% - Homework /Assignments
Nature of the assignments	There are three components to the final grade: 6 quizzes, problem sets and final exam. The contribution of each component to the course grade is as follows: Quizzes -- 40% Problem Sets -- 20% Final Exam -- 40% The 6 quizzes have a duration of 30 minutes each and will be held at the beginning of the following lectures: Sept 11; Oct 2, 16, 30; Nov 13, 27. Only the 5 best quiz grades will be averaged to enter the final grade. The final exam will be held during lecture time on December, 4. Quizzes and final exam are closed book and closed notes. The students are allowed to bring one-sided A4 cheat sheet for the quizzes and final exam. Problem sets will be given as homework. The quizzes will be based on these sets. The grading is given in a Satisfactory(S)/Unsatisfactory(U) system. To pass the course the final grade should be at least 70%.
Course Policies	Students are expected to attend all classes, quizzes and final exam. Absences should be notified in advance and should comply with the university policies. Students that do not show up for a quiz or for the exam should expect a zero in that assessment except for exceptional cases (such as sick leave or other university/advisor approved activities). The students can discuss the homework problems in group but should work out the details individually. Identical homework will be considered as plagiarism and will be marked as zero. Late homework will not be graded except for exceptional cases (such as sick leave or other university/advisor approved activities). No calculators, mobile or laptop allowed during the quizzes or final exam.
Additional Information	

Tentative Course Schedule *(Time, topic/emphasis & resources)*		
Week	**Lectures**	**Topic**
1	Sun 08/25/2019 Wed 08/28/2019	Review of single-variable calculus. Limits, continuity, derivatives, indefinite integrals.
2	Sun 09/01/2019 Wed 09/04/2019	Techniques of integration (by parts, trigonometric substitutions, partial fractions). Definite integrals. Applications.
3	Sun 09/08/2019 Wed 09/11/2019	Coordinates, vectors, dot and cross products. Quiz 1. Vector functions and vector fields.
4	Sun 09/15/2019 Wed 09/18/2019	Coordinates, vectors, dot and cross products, Vector functions and vector fields.
5	Sun 09/22/2019 Wed 09/25/2019	University holiday. Directional derivative and gradient.
6	Sun 09/29/2019 Wed 10/02/2019	Curves (explicit, implicit and parametric forms, level curves). Quiz 2. Velocity, acceleration, arc length and curvature.
7	Sun 10/06/2019 Wed 10/09/2019	Surfaces (explicit, implicit and parametric forms, level surfaces). Line integrals and path independence. Double integrals over rectangular, polar and more general regions.
8	Sun 10/13/2019 Wed 10/16/2019	Volumes and surface areas. Quiz 3. Green's theorem. Surface integrals. Flux.
9	Sun 10/20/2019 Wed 10/23/2019	Stokes theorem. Triple integrals in rectangular, cylindrical and spherical coordinates. The divergence theorem.
10	Sun 10/27/2019 Wed 10/30/2019	Mid-semester break. Quiz 4. Complex numbers. Arithmetic operations. Polar forms. Powers and Roots.
11	Sun 11/03/2019 Wed 11/06/2019	Functions of a complex variable: Exponential, logarithmic, trigonometric, hyperbolic functions. Contour integral. The Cauchy-Goursat theorem.
12	Sun 11/10/2019 Wed 11/13/2019	First-order ordinary differential equations. Initial-value problems and direction fields. Quiz 5. Separable and exact ODE's.
13	Sun 11/17/2019 Wed 11/20/2019	Linear equations. The method of variation of parameters and integrating factors. Second-order linear ordinary differential equations. Homogeneous and non-homogeneous ODE's. Particular solutions.
14	Sun 11/24/2019 Wed 11/27/2019	The method of undetermined coefficients. The method of variation of parameters. Quiz 6. Solving second-order ODE's via the Laplace transform.
15	Sun 12/01/2019 Wed 12/04/2019	Review. Final Exam.
16	Sun 12/08/2019	.

Note

The instructor reserves the right to make changes to this syllabus as necessary.