



Course Syllabus: Engineering Mathematics - AMCS 101

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	AMCS 101
Course Title	Engineering Mathematics
Academic Semester	Fall
Academic Year	2019/2020
Semester Start Date	08/25/2019
Semester End Date	12/10/2019
Class Schedule (Days & Time)	05:30 PM - 07:00 PM Sun Wed

Instructor(s)				
Name	Email	Phone	Office Location	Office Hours
Joaquin Ortega Sanchez	JOAQUIN.ORTEGASANCHEZ@KAUST.EDU.SA		4297, 1, Al-Khwarizmi (bldg. 1)	Sun-Wed 4:00-5:30 pm

Teaching Assistant(s)	
Name	Email
TBA	TBA

Course Information	
Comprehensive Course Description	<p>Functions, inverse functions, graphs. Elementary functions (polynomials, trigonometric functions, exp and log).</p> <p>Limits of functions. Derivatives, Leibniz rule, chain rule. Implicit differentiation.</p> <p>Antiderivative, indefinite integrals. Techniques of integration (integration by parts, substitutions, partial fraction decomposition). The definite integral, the Fundamental Theorem of Calculus. Applications of the integral (area, volume).</p> <p>Introduction to ordinary differential equations. Differential equations of first order, separable equations. Solution of linear differential equations of second order with constant coefficients.</p> <p>Infinite sequences and series, geometric series. Convergence tests for series, comparison, ratio and root tests. Power series and radius of convergence. Taylor series. Taylor series of elementary functions. Error bounds for Taylor approximations.</p> <p>Coordinates and vectors. Lines, circles and parametric equations for curves. Planes. Dot and cross products. Functions of several variables, partial derivatives, tangent planes and normals. Linear approximation, gradient and the differential. Taylor polynomials in several variables.</p>
Course Description from Program Guide	<p>Coordinates, Lines, Circles, Functions and their graphs, Polynomials, trigonometric functions, limits, derivatives, numerical approximation of derivatives, indefinite integrals, the definite integral, the fundamental theorem of calculus, applications of the integral: areas, volumes, numerical integration, transcendental functions, techniques of integration: integration by parts, partial fraction decomposition, substitutions, differential equations of first order, separable equations, numerical integration of differential equations, Euler method, solution of linear differential equations of second order with constant coefficients, Infinite sequences and series, geometric series, convergence tests for series, power series and radius of convergence, Taylor series, approximation of functions by polynomials, exponential, cosine and sine expansions, error bounds. The plane and three-dimensional space, vectors, parametric equations for curves, lines, planes, dot and cross product, functions of several variables, partial derivatives, tangent planes and normals, linear approximation, gradient and the differential</p>
Goals and Objectives	<p>This course is a fast-paced review of calculus of one variable and an introduction to the first concepts of multivariable calculus. The course is intended to organize and review material through exercises.</p>

Required Knowledge	Single-variable calculus and elementary linear algebra.
Reference Texts	<p>James Stewart: Calculus (8th edition, 2015).</p> <p>References:</p> <ol style="list-style-type: none"> 1. A First Course in Calculus, by Serge Lang: https://link.springer.com/book/10.1007/978-1-4419-8532-3 2. Calculus, by Michael Spivak, 3rd Edition: https://archive.org/details/SpivakM.Calculus3rdEd.1994 3. Calculus: Vol. 1, One variable calculus, with an introduction to linear algebra, by Tom Apostol: https://archive.org/details/CalculusTomMApostol 4. Calculus: Basic Concepts and Applications, by R. A. Rosenbaum and G. P. Johnson: https://www.cambridge.org/core/books/calculus/2148F406E2DF4B52BF4D3DBA43E87C09 5. Elementary Analysis: The Theory of Calculus, by Kenneth A. Ross: https://link.springer.com/book/10.1007/978-1-4614-6271-2 6. Introduction to Calculus and Analysis: Vol. I by Richard Courant and Fritz John: https://link.springer.com/book/10.1007/978-1-4613-8955-2
Method of evaluation	<p>30.00% - Final exam 40.00% - Tests 30.00% - Quiz(zes)</p>
Nature of the assignments	<p>There are three components to the final grade: 5 quizzes, 2 tests and a final exam. The contribution of each component to the course grade is as follows:</p> <p>Quizzes -- 30% 2 tests -- 20% each Final exam -- 30%</p> <p>The 5 quizzes have a duration of 20 minutes and will be held at the beginning of a Wednesday class. The exact dates will be announced at the beginning of the course. The two 80-minute tests will be held during lecture time on weeks 7 and 14.</p> <p>All exams, tests and quizzes are closed book and closed notes.</p> <p>Problem sets will be given as ungraded homework. The quizzes will be based on these sets.</p> <p>The grading is given in a Satisfactory(S)/Unsatisfactory(U) system. To pass the course the final grade should be at least 70%.</p>
Course Policies	<p>The students are required to attend all lectures and to take notes. Students that do not show up for a quiz, a test or for the exam should expect a zero in that assessment.</p> <p>The students will read the corresponding material in advance, and the instructor will present a summary of the topics and work out appropriate examples.</p> <p>Use of cellular phones in the classroom is not allowed.</p>
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Sun 08/25/2019 Wed 08/28/2019	Functions and their representation. Inverse functions. Essential functions.
2	Sun 09/01/2019 Wed 09/04/2019	The limit of a function. Calculating basic limits. Limits: indeterminate forms. L'Hopital's rule.
3	Sun 09/08/2019 Wed 09/11/2019	Continuity Quiz 1. Differentiation and its rules.
4	Sun 09/15/2019 Wed 09/18/2019	The chain rule. Implicit differentiation The definite integral. The fundamental theorem of calculus. Substitution
5	Sun 09/22/2019 Wed 09/25/2019	University holiday Quizz 2. Techniques of Integration: by parts.
6	Sun 09/29/2019 Wed 10/02/2019	Techniques of integration: trigonometric substitution, partial fractions. Review for Test 1
7	Sun 10/06/2019 Wed 10/09/2019	Test 1. Applications of the integral
8	Sun 10/13/2019 Wed 10/16/2019	First order differential equations.
9	Sun 10/20/2019 Wed 10/23/2019	Linear differential equations of second order with constant coefficients. Quiz 3. Sequences and Series
10	Sun 10/27/2019 Wed 10/30/2019	Mid-semester break Convergence tests.
11	Sun 11/03/2019 Wed 11/06/2019	Power series. Taylor series. Quiz 4. Parametric equations, arc length and speed. Polar coordinates and conic sections.
12	Sun 11/10/2019 Wed 11/13/2019	Review for Test 2. Test 2.
13	Sun 11/17/2019 Wed 11/20/2019	Vectors. Dot and cross product. Planes. Quadrics. Cylindrical and spherical coordinates.
14	Sun 11/24/2019 Wed 11/27/2019	Functions of several variables: limits, continuity and partial derivatives. Quiz 5. Tangent planes and normals.
15	Sun 12/01/2019 Wed 12/04/2019	Linear approximations, the directional derivative, the gradient and the differential. Taylor polynomials in several variables.
16	Sun 12/08/2019	Final Exam.

Note

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