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

Course Syllabus: Applied Mathematics I - AMCS 201

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	AMCS 201
Course Title	Applied Mathematics I
Academic Semester	Fall
Academic Year	2019/2020
Semester Start Date	08/25/2019
Semester End Date	12/10/2019
Class Schedule (Days & Time)	09:00 AM - 10:30 AM | Tue Thu

Instructor(s)				
Name	**Email**	**Phone**	**Office Location**	**Office Hours**
Ying Wu	Ying.Wu@kaust.edu.sa	+966128080432	4249, 1, Al-Khawarizmi (bldg. 1)	Tuesday afternoons 2:30-4:00pm

Teaching Assistant(s)	
Name	**Email**
TBD	

Course Information	
Comprehensive Course Description	Applied Mathematics I (3 credits). Part of a fast-paced two-course sequence in graduate applied mathematics for engineers and scientists, with an emphasis on analytical techniques. A review of practical aspects of linear operators (superposition, Green's functions, and eigenanalysis) in the context of ordinary differential equations, followed by extension to linear partial differential equations (PDEs) of parabolic, hyperbolic, and elliptic type through separation of variables and special functions. Integral transforms of Laplace and Fourier type. Self-similarity. Method of characteristics linear and quasi-linear PDEs (canonical form, shock wave and expansion wave). No degree credit for AMCS majors.
Course Description from Program Guide	Prerequisites: Advanced and multivariate calculus and elementary complex variables. AMCS 201 and 202 may be taken separately or in either order. Part of a fast-paced two (2)-course sequence in graduate applied mathematics for engineers and scientists, with an emphasis on analytical technique. A review of practical aspects of linear operators (superposition, Greens functions, and eigenanalysis) in the context of ordinary differential equations, followed by extension to linear partial differential equations (PDEs) of parabolic, hyperbolic, and elliptic type through separation of variables and special functions. Integral transforms of Laplace and Fourier type. Self-similarity. Method of characteristics for first-order PDEs. Introduction to perturbation methods for nonlinear PDEs, asymptotic analysis, and singular perturbations. No degree credit for AMCS majors.

Goals and Objectives	1. Understand the concepts of existence and uniqueness theorem, linear dependence, principles of superposition 2. Master the basic techniques in solving ordinary differential equations, incluing integrating factor, variation of parameters, superposition, etc. 3. Understand the concept of Green's function. Master three ways of deriving Green's function. 4. Understand the definition of Sturm-Liouville eigenvalue problems, the properties of eigenvalues and eigenfunctions, orthogonality, etc. 5. Proficient in applying separation of variables and eigenfunction expansion in solving 2nd- order partial differential equations in one, two and three-dimensions with various geometries. 6. Master the method of characteristics in solving PDES, incluing the general method and the parameterized representation. 7. Grasp the methos to solve quasi-linar PDEs. Understand the concepts of shock and expansion waves. 8. Master the classification of three proto-types of 2nd-order PDEs and familiar with the transformation of equations from Catesian coordinates to Canonical coordinates.
Required Knowledge	Advanced and multivariate calculus and elementary complex variables
Reference Texts	Richard Haberman “Applied Partial Differential Equations with Fourier Series and Boundary Value Problems” 5th edition
Method of evaluation	**40.00**% - Final exam **20.00**% - Quiz(zes) **25.00**% - Midterm exam **15.00**% - Homework /Assignments
Nature of the assignments	Homework problem sets will be distributed through blackboard roughly on a weekly basis. They are written assignments.
Course Policies	1. Homework should be submitted independently. Identical homework will be considered as plagiarism and will be marked as zero. 2. Late homework will not be graded except for exceptional cases. (Sick or other university/advisor approved activities) 3. Quizzes and exams are closed book. Singe side of A4- or letter-sized cheat sheet is allowed in the mid-term exam. The same size, double-side cheat sheet is allowed in the final exam. 4. Absences should be notified in advance and should comply with the university policies.
Additional Information	References: 1. Carl M. Bender & Steven A. Orszag “Advanced Mathematical Methods for Scientists and Engineers” 2. Dennis G. Zill & Michael R. Cullen “Advanced Engineering Mathematics”

Tentative Course Schedule *(Time, topic/emphasis & resources)*		
Week	**Lectures**	**Topic**
1	Tue 08/27/2019 Thu 08/29/2019	Introduction, ODE
2	Tue 09/03/2019 Thu 09/05/2019	ODE
3	Tue 09/10/2019 Thu 09/12/2019	ODE, Green's function
4	Tue 09/17/2019 Thu 09/19/2019	Green's function and eigenvalue problem, Quiz #1
5	Tue 09/24/2019 Thu 09/26/2019	Eigenvalue problem
6	Tue 10/01/2019 Thu 10/03/2019	PDE, separation of variables
7	Tue 10/08/2019 Thu 10/10/2019	PDE, separation of variables,
8	Tue 10/15/2019 Thu 10/17/2019	PDE separation of varaibles; Mid-term exam
9	Tue 10/22/2019 Thu 10/24/2019	General PDE
10	Tue 10/29/2019 Thu 10/31/2019	General PDE and method of characteristics
11	Tue 11/05/2019 Thu 11/07/2019	Method of characteristics
12	Tue 11/12/2019 Thu 11/14/2019	Method of characterisitics
13	Tue 11/19/2019 Thu 11/21/2019	Method of characteristics; Quiz #2
14	Tue 11/26/2019 Thu 11/28/2019	Method of characteristics
15	Tue 12/03/2019 Thu 12/05/2019	miscellaneous
16	Tue 12/10/2019	miscellaneous, final review

Note

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