Syllabus for MATH 5545
Mathematical Methods for Science & Engineering , Spring 2014
UMKC Department of Mathematics and Statistics

Content Area	Notes	Reference
Instructor Information		
Department	Mathematics and Statistics	
Name	Majid Bani-Yaghoub	http://b.web.umkc.edu/baniyaghoubm/
Contact Information	Email: baniyaghoubm@umkc.edu Tel: (816) 235- 2845 (I prefer e-mail.)	baniyaghoubm@umkc.edu
Class Meeting Time/Place	Monday & Wednesday 5:30PM - 6:45PM Location: Royall Hall Rm. 311	
Semester Offered	Spring	
Instructor Office Hours and Office Location	Monday & Wednesday 2:00- 3:00 pm or by appointment. Office Location: Manheim 205 A	
Catalog Information		
Subject/Curricular Designation	Mathematics	
Catalog Number	Math 5545	www.umkc.edu/catalog
Course Title	Mathematical Methods for Science & Engineering	
Course Description	This course offers applied linear algebra and Fourier analysis which are indispensable tools in science and engineering. It is designed for beginning graduate students with a moderate background in linear algebra and real analysis. Many of the results that are presented in the course will be proved rigorously from a mathematical point of view.	
Credit Hours	3 credit hours	www.umkc.edu/catalog
Prerequisites/Co-Requisites	Math 402 and Math 420 or consent of the instructor	www.umkc.edu/catalog
Restrictions/Exclusions	None	
Course Component (format)	Lecture	
Course Instructional Mode	P (classroom based)	
Course Information		
Required and Recommended Materials	**1. Required Textbook:** Methods of Applied Mathematics for Engineers and Scientists, 2013 Author: Tomas B. Co, ISBN: 9781107004122 **2. Recommended Textbook:** Advanced Mathematical Methods for Scientists and Engineers* Carl M. Bender and Steven A. Orszag, Springer; 1999 edition ISBN-13: 978-0387989310 **3. Items provided by the instructor:** a. Matlab codes and templates for Matrix, ODE and PDE calculations b. Course handouts on certain topics that are not covered by the textbook	http://b.web.umkc.edu/baniyaghoubm/math5545s14.htm
Evaluation and Grading Criteria	Lab Assignments 5.0 % In-class quiz 10.0 % Midterm exam 20.0 % Homework 25.0 % Final Exam 40.0 % Total 100.0 % A = 93.0-100.0%, A – = 90.0-92.9% B + = 86.6-89.9%, B = 83.0-86.5% B – = 80.0-82.9%, C + = 76.0-79.9% C = 73.0-75.9%, C – = 70.0-72.9% D + = 66.0-69.9%, D = 63.0-65.9% D – = 60.0-62.9%, F = 0-59.9%	

Assignments, Requirements and Assignment deadlines	**Homework:** I will give homework on most Mondays during the semester. Homework includes modeling exercises, numerical explorations and mathematical problems. Late homework will be marked down by 20%. Homework will not be accepted more than a week late. **Quiz:** Each quiz takes 10-15 minutes and you may use your textbook to answer the questions. There will be no make-up quiz. The quizzes are usually on Mondays. **Exams:** There will be a midterm exam on Wednesday March 19, 2014 and a final comprehensive exam on Monday, May 12, 5:45-7:45 p.m. Both exams are open-book exams. **Computational Software:** Matlab (http://www.mathworks.com) will be used to compare the approximated solutions with the exact numerical solutions of differential and integral equations. No previous experience in Matlab coding is necessary. **Access to Matlab:** You may access Matlab through UMKC Remote labs. For more information see http://www.umkc.edu/is/remotelabs Also, Royal Hall computer lab 303 can be used throughout the semester. The lab hours are as follows. Monday – Thursday 8:00 a.m. - 9:00 p.m. Friday – 8:00 a.m. - 5:00 p.m. Saturday & Sunday – Closed Note that these labs are occasionally closed for classes or maintenance. For possible changes in the lab hours see http://www.umkc.edu/is/labs/hoursLocations/index.asp	http://www.umkc.edu/is/remotelabs http://www.umkc.edu/is/labs/hoursLocations/index.asp
Schedule of Course Topics Covered,	Main topics covered: Matrix Algebra, Matrix Analysis, Vector and Tensor Algebra and Calculus, Vector Integral Theorems, Analytical Solutions of Ordinary Differential Equations, Qualitative Analysis of Ordinary Differential Equations, Series Solutions of Linear Ordinary Differential Equations,First-Order Partial Differential Equations and the Method of Characteristics, Linear Partial Differential Equations, and Integral Transform Methods **It is planned to cover chapters 1, 3-6, 8-12 of the textbook.** Below is a rough outline the topics and the anticipated schedule (**Subject to change)**	
January 22.	Review of Matrix Algebra (Block Matrix Operations, Matrix Calculus)	
January 27 & 29	Sparse Matrices, Matrix Operators, Eigenvalues and Eigenvectors	
February 3 & 5	Properties of Eigenvalues and Eigenvectors, Schur Triangularization and Normal Matrices	
February 10 & 12	Jordan Canonical Form, Functions of Square Matrices, Stability of Matrix Operators	
February 17 & 19	Singular Value Decomposition, Polar Decomposition, Matrix Norms	
February 24 & 26	Vector Algebra Based on Orthonormal Basis Vectors, Tensor Algebra, Matrix Representation of Vectors and Tensors, Application to Position Vectors	
March 3 & 5	Review of Vector Integral Theorems (Green's Lemma, Divergence Theorem, Stokes' Theorem and Path Independence, Applications, and Leibnitz Derivative Formula)	
March 10 & 12	Second-Order Ordinary Differential Equations, Multiple Differential Equations, Decoupled System Descriptions via Diagonalization	
March 17 & 19	Laplace Transform Methods, **Midterm Exam (March 19)**	
March 24 & 26	**Spring Break (no classes)**	
March 31 & April 2	Series Solutions of Linear Ordinary Differential Equations (Power Series Solutions, Legendre Equations, Bessel Equations)	
April 7 & 9	Qualitative Analysis of Ordinary Differential Equations (Autonomous Systems and Equilibrium Points, Integral Curves, Phase Space, Flows, and Trajectories, Linearization Around Equilibrium Points, Method of Lyapunov Functions)	
April 14 & 16	First-Order Partial Differential Equations and the Method of	

April 21 & 23	Nonhomogeneous Partial Differential Equations, Similarity Transformations	
April 28 & 30	General Integral Transforms, Fourier Transforms, Solution of PDEs Using Fourier Transforms	
May 5 & 7	Laplace Transforms, Solution of PDEs Using Laplace Transforms, Method of Images (May 8th and 9th are A&S reading days)	
Student Learning Outcomes	The main purpose of this course is to introduce analytic methods of applied mathematics. By the end of the semester the students should (a) understand the main concepts of Matrix, Vector and Tensor Algebra (b) be able to find analytical solutions of linear ordinary differential equations (ODEs) (c) be able to provide qualitative analysis of certain ODEs (d) comprehend the principles series solutions of ODEs (e) know basics of multi-scale analysis and the boundary layer methods. (f) gain experience in using Matlab for basic numerical simulations and solving certain initial and boundary value problems. (g) be able to use Integral transform methods (e.g. Fourier and Laplace) for solving partial differential equations.	http://www.umkc.edu/assessment/downloads/handbook-2011.pdf http://www.umkc.edu/assessment/index.cfm Nathan Lindsay, Assistant Vice Provost for Assessment 816-235-6084 lindsayn@umkc.edu
Course Expectations, Course Policies, Requirements and Standards for Student Coursework and Student Behavior	(i) Attendance of lectures and labs are necessary. (ii) If you must miss a class, please contact me as soon as you know.	
Resources & Policy Statements		
Academic Calendar	Instructors may want to list important add, drop or withdraw dates.	http://www.umkc.edu/registrar/acal.asp
Academic Honesty	The Board of Curators of the University of Missouri recognizes that academic honesty is essential for the intellectual life of the University. Faculty members have a special obligation to expect high standards of academic honesty in all student work. Students have a special obligation to adhere to such standards. Academic dishonesty, including cheating, plagiarism or sabotage, is adjudicated through the University of Missouri Student Conduct Code and Rules of Procedures in Student Conduct Matters. Academic units may have additional student codes of behavior to be referenced.	School of Pharmacy Honor Codes School of Medicine Honor Codes School of Dentistry Honor Codes School of Nursing Honor Codes School of Law Honor Codes
Academic Inquiry, Course Discussion and Privacy	University of Missouri System Executive Order No. 38 lays out principles regarding the sanctity of classroom discussions at the university. The policy is described fully in Section 200.015 of the Collected Rules and Regulations. In this class, students may not make any audio or video recordings of course activity (including those recordings prepared by an instructor), except students permitted to record as an accommodation under Section 240.040 of the Collected Rules. All other students who record and/or distribute audio or video recordings of class activity are subject to discipline in accordance with provisions of Section 200.020 of the Collected Rules and Regulations of the University of Missouri pertaining to student conduct matters. Those students who have written permission from the course instructor to record are not permitted to redistribute any audio or video recordings of statements or comments from the course to individuals who are not students in the course without the express permission of the faculty member and of any students who are recorded, including those recordings prepared by an instructor. Students found to have violated this policy are subject to discipline in accordance with provisions of Section 200.020 of the Collected Rules and Regulations of the University of Missouri pertaining to student conduct matters.	Executive Order #38 (CRR 200.015)

Attendance Policy	Students are expected to attend and participate in classes. Advance notice of attendance policies of academic units and individual instructors should be given, and such notice should be in writing. Students should notify instructors of excused absences in advance, where possible. Students who have an excused absence are expected to make arrangements with instructors for alternative or make-up work. Such arrangements should be made in advance of the absence, where possible. Instructors should accommodate excused absences to the extent that an accommodation can be made that does not unreasonably interfere with the learning objectives of the course or unduly burden the instructor. Attendance policies shall be applied in a non-discriminatory manner.	http://www.umkc.edu/catalog/attendancepolicy
Campus Safety	Inclement weather, mass notification, and emergency response guide.	http://www.umkc.edu/umkcalert/ http://www.umkc.edu/police **Police**: 816-235-**1515 or 911**
Disability Support Services	To obtain disability related accommodations and/or auxiliary aids, students with disabilities must contact the Office of Services for Students with Disabilities (OSSD) as soon as possible. To contact OSSD call 816-235-5696. Once verified, OSSD will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. For more information go to: http://www.umkc.edu/disability/.	http://www.umkc.edu/disability/
English Proficiency Statement	Students who encounter difficulty in their courses because of the English proficiency of their instructors should speak directly to their instructors. If additional assistance is needed, they may contact the UMKC Help Line at 816- 235-2222 for assistance.	
Grade Appeal Policy	Students are responsible for meeting the standards of academic performance established for each course in which they are enrolled. The establishment of the criteria for grades and the evaluation of student academic performance are the responsibilities of the instructor. This grade appeal procedure is available only for the review of allegedly capricious grading and not for review of the instructor's evaluation of the student's academic performance. Capricious grading, as that term is used here, comprises any of the following: • The assignment of a grade to a particular student on some basis other than the performance in the course; • The assignment of a grade to a particular student according to more exacting or demanding standards than were applied to other students in the course; (**Note:** Additional or different grading criteria may be applied to graduate students enrolled for graduate credit in 300- and 400-level courses.) • The assignment of a grade by a substantial departure from the instructor's previously announced standards.	http://www.umkc.edu/catalog/gradeappeals
Discrimination Grievance Procedures for Students		http://www.umsystem.edu/ums/rules/collected_rules/grievance/ch390/grievance_390.010 http://www.umkc.edu/diversity/documents/complaintprocess.pdf
Statement of Human Rights	The Board of Curators and UMKC are committed to the policy of equal opportunity, regardless of race, color, religion, sex, sexual orientation, national origin, age, disability and status as a Vietnam era veteran. Commitment to the policy is mentored by the Division of Diversity, Access & Equity, but it is the responsibility of the entire university community to provide equal opportunity through relevant practices, initiatives and programs.	Division of Diversity, Access & Equity 5115 Oak Street (816)235-**1323** Fax:(816)235-**6537** umkcaffirmativeaction@umkc.edu http://www.umkc.edu/diversity/index.asp