

Syllabus for MATH 5532
Advanced Numerical Analysis I, Fall 2017
UMKC Department of Mathematics and Statistics

| Content Area | Notes | Reference |
|--|---|---|
| Instructor Information | | |
| Department | Mathematics and Statistics | |
| Name | Dr. 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 | Tuesday and Thursday 4:00PM-5:15PM / Royall Hall, Rm. 205 | |
| Semester Offered | Fall 2017 | |
| Instructor Office Hours and Office Location | Tuesday and Thursday 12:00 - 1:00 PM or by appointment. Office Location: Manheim 205 A | |
| Catalog Information | | |
| Subject/Curricular Designation | Mathematics | www.umkc.edu/catalog |
| Catalog Number | Math 5532 | www.umkc.edu/catalog |
| Course Title | Advanced Numerical Analysis I | www.umkc.edu/catalog |
| Course Description | Error Analysis, Solving Systems of Linear Equations, Solutions of Nonlinear Equations, the Least-Squares Problems, and Approximating functions. | www.umkc.edu/catalog |
| Credit Hours | 3 credit hours | www.umkc.edu/catalog |
| Prerequisites/Co-Requisites | MATH 402, MATH 420. | www.umkc.edu/catalog |
| Restrictions/Exclusions | None | |
| Course Component (format) | Lecture | |
| Course Instructional Mode | P (classroom based) | |
| Course Information | | |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|--|--|-------------------------------|-------------|-----|--------------------------------|--------------|-----|----------------------------------|----------|-----|--------------------------------|------------|------------|--------------------------------|-------|------|-----------------------------|--|
| Required and Recommended Materials | <p>1. Required Textbook: Numerical Analysis, 10th Edition (2015) by Richard L. Burden, J. Douglas Faires and Annette M. Burden, ISBN-13: 978-1305253667</p> <p>2. Recommended Textbook: Introduction to Numerical Analysis, 10th Edition (2002) by Josef Stoer and R. Bulirsch, ISBN-13: 978-1441930064</p> | | | | | | | | | | | | | | | | | | | |
| Evaluation and Grading Criteria | <table border="0"> <tr> <td></td> <td></td> <td>A = 93.0-100.0, A – = 900-929</td> </tr> <tr> <td>Weekly quiz</td> <td>15%</td> <td>B + = 86.6-89.9, B = 83.0-86.5</td> </tr> <tr> <td>Midterm exam</td> <td>25%</td> <td>B – = 80.0-82.9, C + = 76.0-79.9</td> </tr> <tr> <td>Homework</td> <td>30%</td> <td>C = 73.0-75.9, C – = 70.0-72.9</td> </tr> <tr> <td>Final Exam</td> <td><u>30%</u></td> <td>D + = 66.0-69.9, D = 63.0-65.9</td> </tr> <tr> <td>Total</td> <td>100%</td> <td>D – = 60.0-62.9, F = 0-59.9</td> </tr> </table> | | | A = 93.0-100.0, A – = 900-929 | Weekly quiz | 15% | B + = 86.6-89.9, B = 83.0-86.5 | Midterm exam | 25% | B – = 80.0-82.9, C + = 76.0-79.9 | Homework | 30% | C = 73.0-75.9, C – = 70.0-72.9 | Final Exam | <u>30%</u> | D + = 66.0-69.9, D = 63.0-65.9 | Total | 100% | D – = 60.0-62.9, F = 0-59.9 | |
| | | A = 93.0-100.0, A – = 900-929 | | | | | | | | | | | | | | | | | | |
| Weekly quiz | 15% | B + = 86.6-89.9, B = 83.0-86.5 | | | | | | | | | | | | | | | | | | |
| Midterm exam | 25% | B – = 80.0-82.9, C + = 76.0-79.9 | | | | | | | | | | | | | | | | | | |
| Homework | 30% | C = 73.0-75.9, C – = 70.0-72.9 | | | | | | | | | | | | | | | | | | |
| Final Exam | <u>30%</u> | D + = 66.0-69.9, D = 63.0-65.9 | | | | | | | | | | | | | | | | | | |
| Total | 100% | D – = 60.0-62.9, F = 0-59.9 | | | | | | | | | | | | | | | | | | |
| Assignments, Requirements and Assignment deadlines | <p>Homework: I will give homework on most Tuesdays during the semester. Late homework will be marked down by 20%. Homework will not be accepted more than a week late.</p> <p>Quiz: Each quiz takes 10-15 minutes and you may use your textbook to answer the questions. There will be no make-up quizzes.</p> <p>Exams: There will be a midterm exam (October 17) during the class hours. The final exam (Friday, Dec. 15, 10:30 a.m.-12:30 p.m.) will be comprehensive. All exams are closed-book exams.</p> <p>Access to Matlab: For numerical explorations, 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.</p> <p>Monday – Thursday 8:00 a.m. - 9:00 p.m. Friday – 8:00 a.m. - 5:00 p.m. Saturday & Sunday – Closed</p> <p>For possible changes in the lab hours see http://www.umkc.edu/is/labs/hoursLocations/index.asp</p> | <p>http://www.mathworks.com</p> <p>http://www.umkc.edu/is/remotelabs</p> <p>http://www.umkc.edu/is/labs/hoursLocations/index.asp</p> | | | | | | | | | | | | | | | | | | |
| Schedule and Course Topics (Important Note: Subject to change) | <p>It is planned to cover the following chapters and sections of the textbook by Burden et al.: Chapters 1, 4, 5, 6, and Sections 10.1, 10.2, and 10.3</p> <p>The course schedule and topics are subject to change.</p> | | | | | | | | | | | | | | | | | | | |
| Week # 1 | <p>Chapter 1 MATHEMATICAL PRELIMINARIES AND ERROR ANALYSIS. Round-off Errors and Computer Arithmetic. Algorithms and Convergence.</p> | | | | | | | | | | | | | | | | | | | |

| | |
|-----------|--|
| Week # 2 | Introduction to Matlab Chapter 4 NUMERICAL DIFFERENTIATION AND INTEGRATION Numerical Differentiation, Richardson's Extrapolation. |
| Week # 3 | Elements of Numerical Integration, Composite Numerical Integration. |
| Weeks # 4 | Romberg Integration, Adaptive Quadrature Methods, Gaussian Quadrature |
| Weeks # 5 | Multiple Integrals, Improper Integrals, Matlab Coding |
| Week # 6 | Chapter 5. INITIAL-VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS The Elementary Theory of Initial-Value Problems. Euler's Method |
| Week # 7 | Higher-Order Taylor Methods, Review for Midterm Exam (October 12) |
| Week # 8 | Midterm Exam (October 17) , Runge-Kutta Methods |
| Week # 9 | Error Control and the Runge-Kutta-Fehlberg Method, Multistep Methods. |
| Week # 10 | Variable Step-Size Multistep Methods. Extrapolation Methods. Higher-Order Equations and Systems of Differential Equations |
| Week # 11 | Stability, Stiff Differential Equations and Matlab Coding |
| Week # 12 | Chapter 6. DIRECT METHODS FOR SOLVING LINEAR SYSTEMS Linear Systems of Equations, Pivoting Strategies |
| Week # 13 | Linear Algebra and Matrix Inversion. The Determinant of a Matrix. Matrix Factorization. Special Types of Matrices Thanksgiving Holiday (November 20-24) |
| Week # 14 | Chapter 10. NUMERICAL SOLUTIONS OF NONLINEAR SYSTEMS OF EQUATIONS Fixed Points for Functions of Several Variables, Newton's Method, Quasi-Newton Methods, Steepest Descent Techniques. |
| Week # 15 | Review for Final Exam (Dec. 5). Last day of class is Dec. 5. Dec. 7 and 8 are the reading days. Final Exam: Friday, Dec. 15, 10:30 a.m.-12:30 p.m. |

| | | |
|---|---|---|
| Student Learning Outcomes | <p>Students will be able to:</p> <ol style="list-style-type: none"> 1. demonstrate competence with and understanding of the concepts of a numerical algorithm and computer programming; 2. demonstrate competence with and understanding of the concepts of error analysis, convergence, and stability of numerical methods; 3. compute numerically the derivatives and the integrals of a function; 4. solve initial value problems using Euler’s method, the higher order Taylor’s method, and the Runge-Kutta Method; solve higher-order differential equations, system of differential equations and stiff differential equations; 5. solve linear systems numerically using direct methods as well as iterative methods; solve nonlinear systems of equations using Fixed point method, Newton’s method, and Quasi-Newton’s method; 6. Gain experience in computer programming and independent research project. | |
| Course Expectations, Course Policies, Requirements and Standards for Student Coursework and Student Behavior | <p>(a) Attendance of lectures is extremely important . If you must miss a class, please contact me as soon as you know.</p> <p>(b) Students need to be familiar with the methods and techniques used in calculus.</p> <p>(c) Please keep your cell phones off during the class time.</p> | |
| Resources & Policy Statements | | |
| Academic Calendar | Students are encouraged to review important add, drop or withdraw dates: | http://www.umkc.edu/register/ral.acal.asp |
| Academic Honesty | <p>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.</p> <p>Academic units may have additional student codes of behavior to be referenced.</p> | School of Pharmacy Honor Codes or 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 | <p>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 make audio or video recordings of course activity unless specifically prohibited by the faculty member. However, the redistribution of any audio or video recordings of statements or comments from the course to individuals who are not students in the course is prohibited 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.</p> | <p>Executive Order #38 (CRR 200.015)</p> |
| Attendance Policy | <p>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.</p> | <p>http://www.umkc.edu/catalog/attendancepolicy</p> |
| Campus Safety | <p>Inclement weather, mass notification, and emergency response guide. Campus Police: 816-235-1515 or 911</p> | <p>http://www.umkc.edu/umkc/alert/ http://www.umkc.edu/police Police: 816-235-1515 or 911</p> |
| Counseling and Health Services Available at UMKC | <p>UMKC students may experience many challenges in their lives while attending college – stress, depression, suicidality, trauma, relationship issues, health concerns, etc. As your professor I care about your success and well-being, and want to make you aware of some helpful resources on campus. The UMKC Counseling Center (www.umkc.edu/counselingcenter), located at 4825 Troost in Room 206, offers a wide range of supportive services to students. Appointments can be made by calling 816.235.1635. UMKC Student Health and Wellness (http://info.umkc.edu/studenthealth/), located at 4825 Troost in Room 115, offers a full range of health care and promotion services. Appointments can be scheduled online or by calling 816.235.6133. The MindBody Connection (www.umkc.edu/mindbody) is located in the Atterbury Student Success Center in Room 112 and offers a variety of stress-reduction services.</p> | <p>www.umkc.edu/counselingcenter</p> |
| Disability Support Services | <p>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/.</p> | <p>http://www.umkc.edu/disability/</p> |

| | | |
|---|--|--|
| 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 | <p>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:</p> <ul style="list-style-type: none"> • 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 | Discrimination Grievance Procedures for Students can be found here: http://www.umsystem.edu/ums/rules/collected_rules/grievance/ch390/grievance_390.010 | http://www.umsystem.edu/ums/rules/collected_rules/grievance/ch390/grievance_390.010 http://www.umkc.edu/diversity/documents/complaintprocess.pdf |

| | | |
|--|--|--|
| <p>Title IX</p> | <p>Under the University of Missouri’s Title IX policy, discrimination, violence and harassment based on sex, gender, and gender identity are subject to the same kinds of accountability and support applied to offenses based on other protected characteristics such as race, color, ethnic or national origin, sexual orientation, religion, age, ancestry, disability, military status, and veteran status. If you or someone you know has been harassed or assaulted, you can find the appropriate resources by visiting UMKC’s Title IX Office webpage (http://info.umkc.edu/title9/) or contacting UMKC’s Title IX Coordinator, Mikah K. Thompson (816.235.6910 or thompsonmikah@umkc.edu). Additionally, you can file a complaint using UMKC’s online discrimination complaint form, which is located at http://info.umkc.edu/title9/reporting/report-online/.</p> <p>While most UMKC employees are required to report any known or suspected violation of Title IX, students may seek confidential guidance from the following campus locations:</p> | |
| <p>UMKC Counseling Service, Volker Campus 4825 Troost Ave, Suite 206 Kansas City, MO 64110 Phone – (816) 235-1635</p> | <p>UMKC Counseling Service, Health Sciences Campus Health Sciences Building 1418 2464 Charlotte Kansas City, MO 64108 Phone – (816) 235-1635 (open Tuesdays, 1-5pm)</p> | <p>Student Health and Wellness 4825 Troost Ave., Suite 115, Kansas City, MO 64110 Phone - (816) 235-6133</p> |
| <p>UMKC Connect</p> | <p>Important information is available to undergraduate students in UMKC Connect accessed through Blackboard. Throughout the term, students may receive emails regarding course grades or academic performance. Students are expected to address information posted in a timely fashion. This information may be shared with the student’s Success Network made up his or her academic advisor(s) and other campus resources so that UMKC may fully support the student’s success.</p> | |
| <p>Statement of Human Rights</p> | <p>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.</p> | <p>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</p> |