UMBC UGC Change in Existing Course: ENME303 Engineering Mathematics

Date Submitted: 2/20/2019 Proposed Effective Date: 8/31/2019

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Other Contact				

COURSE INFORMATION: (please provide all information in the "current" column, and only the information changing in the "proposed" column)

change		current	proposed
☐	Course Number(s)	ENME303	
x☐	Formal Title	Engineering Mathematics	Computational Methods for Engineers
☐	Transcript Title (≤30c)		
☐	Recommended Course Preparation		
☐	Prerequisite **NOTE:** Unless otherwise indicated, a prerequisite is assumed to be passed with a "D" or better.	You must have completed MATH225 and MATH 251 and ENME220 and ENME221 all with a grade of "C" or better.	
☐	# of Credits Must adhere to the UMBC Credit Hour Policy	3	
☐	Repeatable?	☐ Yes x☐ No	☐ Yes ☐ No
☐	Max. Total Credits	3	**Max. Total Credits:** This should be equal to the number of credits for courses that cannot be repeated for credit. For courses that may be repeated for credit, enter the maximum total number of credits a student can receive from this course. E.g., enter 6 credits for a 3 credit course that may be taken a second time for credit, but not for a third time. Please note that this does NOT refer to how many times a class may be retaken for a higher grade.
☐	Grading Method(s)	x☐ Reg (A-F) ☐ Audit ☐ Pass-Fail	☐ Reg (A-F) ☐ Audit ☐ Pass-Fail

CURRENT CATALOG DESCRIPTION:

Introduction to programming using MATLAB. Elements of linear algebra and numerical solution of ordinary differential equations with application in engineering.

PROPOSED CATALOG DESCRIPTION (Approximately 75 words in length. Please use full sentences): leave blank if no changes are being proposed to the catalog description. NOTE: information about prerequisites should NOT appear in the catalog description.)

This course is intended as an introduction to programming using MATLAB, elements of linear algebra, computational methods, and their application to solving engineering and scientific problems through computational programming.

RATIONALE FOR CHANGE:

The current title "Engineering Mathematics" in most universities across the nation contains topics such as differential equations and their exact solutions, Laplace transform, Fourier series, vector calculus (and Green and Gauss theorems), theory of complex variables. Nearly all these topics are not in the current course ENME303.

The current contents are contained in courses across with variable titles, such as "Problem Solving" and "Numerical Methods for Engineers," or some variants of them. Since the topics in the current ENME303 involves computer programming to get numerical solutions (which are numerical and approximate in nature) for archetypical equations encountered in engineering and physical problems, it is appropriate to rename it with a title containing "computing" or "computational." The Undergraduate Committee of Mechanical Engineering Department has met and deliberated on the rationale for changing the course title, while the State of Maryland has recently placed emphasis on generating future work force that is versed in computing.

While ENME303 has always been about computing and not the same as prevailing concept of "Engineering Mathematics," the new title of "Computational Methods for Engineers" should be appropriate and does justice to both the content of the course and the capability our students gain through their course work.

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Engineering Mathematics
ENME 303

Instructor
Asst. Prof. Carlos A. Romero-Talamás
Department of Mechanical Engineering, UMBC
Email: romero@umbc.edu
Office: Engineering, Room 212.
Office Hours: TuTh 1:00 PM – 2:30 PM.
(or by appointment if your courses overlap with these hours)

Teaching Assistants/Teaching Fellows
TBD

Lecture Meeting Hours and Location
TuTh 4:00 PM – 4:50 PM
Physics 101

Final Exam: Tuesday, May 21, 2019, 3:30 – 5:30 PM.

Laboratory Meetings Hours and Location
ENME 303-02: We 5:00 – 6:50 PM Engineering 114
ENME 303-03: TBD

Textbook
Numerical Methods for Engineers, 7th edition
by Steven C. Chapra, Raymond P. Canale

The ConnectPlus feature from McGraw Hill (which includes the electronic textbook) is required for online assignments. Please access it through Assignments in Blackboard.

Course Motivation: This course is an introduction to numerical methods and their application to solving engineering and scienfic problems through computational programming.

Course Objectives: The student will learn practical numerical methods used to solve engineering problems. The primary focus will be on the use and solution of linear algebra problems, determination of eigenvalues and eigenvectors, curve fitting to data, finding roots of equations, numerical evaluation of differentials and integrals, and numerical solution of ordinary differential equations. To implement the methods covered in class, the student will learn basic programming, pseudocode representation, and programming in the MATLAB environment.

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Engineering Mathematics
ENME 303

Course Outline

Note: The topics covered per week and exam dates are approximate and subject to change.

Week	Topic	Sections
(01/28 – 02/1)		
1	Introduction	PT1.1 – PT1.2
	The Matlab environment.	(Bb notes)
	Use of built-in functions; graphics.	
(02/4 – 02/8)		
2	Mathematical Modeling; Engineering Problem Solving	1.1 – 1.2
	Programming in MATLAB	2.1 – 2.5
(02/11 – 02/15)		
3	Approximation and Round Off Errors	3.1 – 3.4
	Truncation Errors and the Taylor Series	4.1 – 4.4
(02/18 – 02/22)		
4	Roots of Equations; Bracketing Methods	5.1 – 5.4
	Open Methods; Newton-Raphson Method	6.1 – 6.2
(02/25 – 03/1)		
	02/26 Partial Exam 1	
5	Secant Method	6.3
(03/4 – 03/8)		
6	Matrices (Review); Linear Algebra Intro	PT3.1 – PT3.2
	Naïve Gauss Elimination	9.1 – 9.3
(03/11 – 03/15)		
7	Gauss Elimination with Partial Pivoting	9.4
	Special Matrices and Gauss-Seidel	11.1 – 11.2
(03/25 – 03/29)		
8	Least-Squares Regression	17.1
	Polynomial Regression; Multiple Linear Regression	17.2 – 17.3
(04/01 – 04/5)		
9	Interpolation; Newton's Divided Difference	18.1
	Lagrange Polynomials; Reverse Interpolation	18.2, 18.4
(04/8 – 04/12)		
	04/9 Partial Exam 2	
10	Spline Interpolation	18.6
	Numerical Integration; Trapezoid Rule	21.1

(04/15 – 04/19)

11	Simpson's rule	21.2
	Numerical Differentiation, Ordinary Diff. Eq.;	23.1 - 23.2
	Euler's Method	25.1 - 25.2

(04/22 – 04/26)

12	Runge-Kutta Methods	25.3 – 25.4

(04/29 – 05/3)

13	Boundary-Value and Eigenvalue Problems	27.1 – 27.2

(05/6 – 05/14)

05/9 Partial Exam 3

14,15 Review (if time permits).

Grading Scheme

Grades will be based on a combination of lab quizzes, short tests, and homework (30%), partial exams (45%), and a final exam (25%).

Final grades are distributed as follows:
90 – 100 ….**A**
80 – 89.9 ....**B**
70 – 79.9 ....**C**
60 – 69.9 ....**D**
0 – 59.9......**F**

Attendance

Students are expected to attend all class and laboratory sessions, and are responsible for noting all material covered. There is a reasonable effort to communicate with students through email and/or Blackboard, particularly in cases when inclement weather or otherwise force cancellation of class. However, students are responsible for noting any announcement or correction to the material made only in class.

University policy will be followed with respect to absences due to illness, religious observances, participation in University activities, and compelling circumstances beyond the student's control.

Students with disabilities

Students with disabilities should contact the instructor as soon as possible to accommodate particular needs in the course materials, lectures, and classroom.

Academic Integrity

By enrolling in this course, each student assumes full responsibility of as a participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty. Academic misconduct could result in disciplinary action that may include, but is not limited to a grade of zero on the particular work, a grade of F in the class, suspension or dismissal. To read the full Student Academic Conduct Policy, consult the UMBC Student handbook, the Faculty Handbook, or the UMBC Policies section of the UMBC Directory. See also
https://aetp.umbc.edu/files/2015/09/iii-1.10.03.pdf