MEC 320: Numerical Methods in Engineering Design and Analysis

Fall 2018 (SUNY Korea)

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Class Time and Location: MW: 10:30 – 11:50 am, B313

Instructor: Professor Foluso Ladeinde **Office Location:** **B619**

Preferred E-mail Address: foluso.ladeinde@stonybrook.edu

Instructor Office Hours (Tentative): M: 5:00 – 6:30 PM, TU: 2:00 – 3:30 PM

TA: Somnic Jacobs **TA Office Hours**: TBD

Credits: 3

Pre-requisites: MEC 102 or CSE 114 or CSE 130 or ESG 111 or ESE 124; AMS 261 or MAT 203; AMS 361 or MAT 303.

Textbook: 1. Numerical Methods for Engineers, Steven C. Chapra and Raymond P. Canale, McGraw-Hill, Seventh Edition
2. Lecture notes on Optimum Design and System Simulation

Course Description:

This course emphasizes the implementation of numerical methods for computer-aided solutions to problems that arise in engineering design and analysis. Methods include interpolation, extrapolation, curve fitting, and integration and techniques for solving non-linear equations, systems of linear equations, and differential equations. Optimization in engineering design is covered from the formulation of design specifications and criteria, to analyzable models, through to numerical implementation.

Week 1.	Introduction: Modeling, Computers, Programming/Software, and Error Analysis	8/27-8/31
Week 2.	Roots of Non-Linear Equations	9/3-9/7
Week 3.	Roots of Non-Linear Equations	9/10-9/14
Week 4.	System of Linear/Non-Linear Algebraic Equations (Midterm I: 9/19)	9/17-9/21
Week 5	No Classes	9/24-9/28 (M-F)
Week 6.	Introduction to Optimum Design	10/1 (Mon)
	No Classes	10/3 (Wed)
Week 7	No Classes	10/8 (Mon), 10/9 (Tu)
	Introduction to Optimum Design/Num.	10/10

	Meth. Optimization, Constrained Optimization	
Week 8.	Numerical Methods for Optimization, Constrained Optimization	10/15 – 10/19
Week 9.	Linear Programming	10/22-10/26
Week 10.	Numerical Differentiation and Integration Methods	10/29-11/2
Week 11.	Numerical Differentiation and Integration Methods	11/5-11/9
Week 12.	Numerical Solution of Ordinary Differential Equations (Midterm II: 11/12)	11/12-11/16
Week 13.	Numerical Solutions of IVP's (ODE's), R-K & predictor corrector.	11/19-11/23
Week 14.	Numerical Solutions of two-point BVP's by finite difference & shooting methods	11/26-11/30
Week 15.	Curve-Fitting (Least Squares & Fourier Approximations), Engineering System Simulation	12/3-12/7
Weeks 16.	Engineering System Simulation	12/10-12/12
	Finals Begin	**12/14 (Friday)**
	Commencement	12/21, 1:30 PM

Homework: Approximately one homework assignment per week
Homework will be due one week after it is assigned.
Late homework will receive half credit before the solutions are posted and will not be accepted after that.

Exams: 2 Midterms with Competency Questions
1 Final Exam with Competency Questions
All exams will be scheduled in class, unless otherwise stated
No makeup exam unless arranged prior to the exam.

Grading Scale Will grade on a curve

Grading:

Midterm I: 25%
Midterm II: 25%
Final: 35% (Comprehensive)
Homework: 15%

Homework is to be done individually. Homework must be neat and orderly so that your work can be followed clearly. Solutions which are not clearly written and easy to follow (based on the judgment of the instructor) will not be graded.

Attendance: More than three unexcused absences from class will lead to a final grade of F.

COURSE LEARNING OBJECTIVES	PIs	ASSESSMENT TOOLS
1. Be able to numerically find roots of nonlinear scalar equations	a1	Competency Exams
2. Be able to numerically solve systems of linear algebraic equations	a1	Competency Exams
3. Be able to interpolate and extrapolate a data set	a1	Competency Exams
4. Be able to differentiate and integrate numerically	a2	Competency Exams
5. Be able to pose and understand the nature of an optimal design problem	e2, e3	Competency Exams
6. Be able to solve unconstrained and constrained optimization problems numerically.	a2, k2	Competency Exams
7. Be able to find numerical solutions of two-point BVP's	a2, k2	Competency Exams
8. Be able to find numerical integrations of ODE IVP's	a2, k2	Competency Exams
9. Be able to use methods of curve fitting	a1	Competency Exams

COGNITIVE DEVELOPMENT	a	b	c	d	e	f	g	h	i	j	k
	2				-/2/1						2
	1 – Knowledge/Comprehension, 2 – Application/Analysis, 3 – Synthesis/Evaluation										

It is important to note that in order for you to earn a passing grade in this class, you have to compete and pass *all* three "Competency Exams" listed above. Failure to comply with this requirement of competency exams will result in a letter grade of "F".

Statement on Academic Dishonesty

Academic dishonesty is an extremely serious offense and will not be tolerated in any form. Academic dishonesty in general is the presentation of intellectual work that is not originally yours. Examples include, *but are not limited to*, copying or plagiarizing class assignments including homework, reports, designs, and other submitted materials; copying or otherwise communicating answers on exams with other students; bringing unapproved aids, either in physical (written) or electronic form to an exam; obtaining copies of an exam prior to its administration, etc. Academic dishonesty violates both the ethical and moral standards of the Engineering profession and all infractions related to

If you have a physical, psychological, medical or learning disability that may impact on your ability to carry out assigned course work, I would urge that you contact the staff in the Disabled Student Services office (DSS), Room 133, Humanities, 632-6748v/TDD. DSS will review your concerns and determine with you what accommodations are necessary and appropriate. All information and documentation of disability is confidential.

academic dishonesty will be prosecuted to the fullest via the CEAS CASA committee. For you, the honest student, academic dishonesty results in lower class curves, hence a depression in your GPA and class standing, while cheapening the degree you earn.

Allowed Calculators

Following the Mechanical Engineering Department's mandatory calculator policy, **only** the following calculators will be allowed to be used on the midterm and final exams. There will be no exceptions. This list of calculators is identical to that allowed for the *National Council for Examiners for Engineering and Surveying* (NCEES) Fundamentals of Engineering (FE) exam that many of you will take in your senior year, as well as the Professional Engineering (PE) exam that you may take several years from now. The sooner you become comfortable on one of these calculators, the better. If you have any questions on this policy please feel free to contact me. The NCEES policy on calculators can be found here: http://www.ncees.org/exams/calculators/ .

Casio:	All **fx-115** models. Any Casio calculator must contain **fx-115** in its model name.
Hewlett Packard:	The **HP 33s** and **HP 35s** models, but no others.
Texas Instruments:	All **TI-30X** and **TI-36X** models. Any Texas Instruments calculator must contain either **TI-30X** or **TI-36X** in its model name.