North South University

Department of Civil and Environmental Engineering (DCEE)

CEE 215: Numerical Analysis & Computer Programming

Course Outline

1 BASIC INFORMATION

1.1 COURSE CONTENTS

1. Numerical solution of algebraic and transcendental equations
2. Solutions of systems of linear equations
3. Curve-fitting by least squares
4. Finite difference; interpolation
5. Numerical differentiation and integration
6. Numerical solution of differential equations
7. Basic components of computer system
8. Introduction to programming languages
9. Structured and object oriented Programming Languages

1.2 COURSE INFORMATION

1. Undergraduate course
2. 3 credit hours course: 3 hours of classroom contact per week
3. Two classes per week having 1.5 hours of duration
4. The course requires background knowledge on basic calculus, differentiation, integration, and linear algebra

1.3 PREREQUISITE COURSES:

1. MAT130: Calculus & Analytical Geometry II

1.4 FACULTY

1. Name: Md. Tareq Hossain Khondoker, MSc, Lecturer, DCEE, Initial: THK
2. Room No: SAC 738,
3. Phone: Office Ph: +880-2-55668200 Ext: 6233, Mobile: 01854257405
4. E-mail: tareq.khondoker@northsouth.edu
5. Office hours: Every weekday 12:00 pm – 2:00 pm. except Thursday.

1.5 CLASS HOURS:

- Section 1: RA 2:40 pm – 4:10 pm (Room#LIB 602)

1.6 TEXT BOOK:

Numerical Methods for Engineers (7th edition) – Steven C. Chapra, Raymond P. Canale,

1.7 REFERENCE BOOKS:

1. *Numerical Analysis for Engineers and Scientists – G. Miller*

2 COURSE OBJECTIVES AND OUTCOMES

2.1 COURSE OBJECTIVES:

1. Introduce common numerical techniques/methods (involving systems of linear equations, interpolation, regression, and root finding etc.) available for solving engineering problems
2. Provide students with an understanding of the basics of a structured and object oriented programming language for the purpose of numerical computations

2.2 COURSE OUTCOMES (COs):

2.2.1 CO1: Learn and apply common numerical techniques/methods to solve engineering problems involving systems of linear equations, interpolation, regression, and root finding etc.

2.2.2 CO2: Solve pile deflection and beam deflection problems using finite difference method

2.2.3 CO3: Understand the basics of a structured and object oriented programming language and apply the program for the purpose of numerical computations

2.3 MAPPING OF COURSE OUTCOMES TO BSCEE PROGRAM OUTCOMES

L: Slightly maps (low); M: Moderately maps (medium); H: Substantially maps (high)

	PO - 1	PO - 2	PO - 3	PO - 4	PO - 5	PO - 6	PO - 7	PO - 8	PO - 9	PO - 10	PO - 11	PO - 12	PO - 13
CO1		M											
CO2			H										
CO3					H								

2.4 CO DELIVERY AND ASSESSMENT

Course outcomes	Bloom's taxonomy, domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	C1, C3	Lecture, examples, exercises, home work	Quizzes, midterm exams, Final Exam, Assignments
CO2	C4	Lecture, examples, exercises, assignments	Quiz, Final exam, Assignments
CO3	C3	Lecture, problems, solution	In-class exam, Assignment

2.4.1 Cognitive domain (knowledge-based): C

1: Knowledge, 2: Comprehension, 3 Application, 4 Analysis, 5: Synthesis, 6: Evaluation

2.4.2 The affective domain (emotion-based): A

1: Receiving, .2: Responding, 3: Valuing, 4: Organizing, 5: Characterizing

2.4.3 The psychomotor domain (action-based): P

1: Perception, 2: Set, 3: Guided response, 4: Mechanism, 5: Complex overt response, 6: Adaptation, 7: Origination

3 BSCEE PROGRAM OUTCOMES (PO)

3.1.1 PO – 1: Engineering Knowledge

Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex civil engineering problems.

3.1.2 PO – 2: Problem analysis

Identify, formulate, research the literature and analyze complex civil engineering problems and reach substantiated conclusions using first principles of mathematics, the natural sciences and the engineering sciences.

3.1.3 PO – 3: Design/development of solutions

Design solutions for complex civil engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety as well as cultural, societal and environmental concerns.

3.1.4 PO – 4: Investigation

Conduct investigations of complex problems, considering design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.

3.1.5 PO – 5: Modern tool usage

Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex civil engineering activities with an understanding of the limitations.

3.1.6 PO – 6: The engineer and society

Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional civil engineering practice.

3.1.7 PO – 7: Environment and sustainability

Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.

3.1.8 PO – 8: Ethics

Apply ethical principles and commit to professional ethics, responsibilities and the norms of the civil engineering practice.

3.1.9 PO – 9: Individual work and teamwork

Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings.

3.1.10 PO – 10: Communication

Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.

3.1.11 PO – 11: Project management and finance

Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work as a member or a leader of a team to manage projects in multidisciplinary environments.

3.1.12 PO – 12: Life-long learning

Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.

3.1.13 PO – 13: Contemporary Issues

Demonstrate sound knowledge on global and local contemporary civil engineering issues.

4 COURSE ASSESSMENT

4.1 TEACHING/LEARNING STRATEGIES

4.1.1 Lectures

- Attend all classes punctually
- Learn methods that are not precise in the textbook
- Follow worked examples taught in the class and provided in the textbook
- Solve exercises from the textbook and innovative problems in the assignments
- Develop similar MATLAB code taught in the class

4.1.2 Tutorials & Group work

- Contact course instructor/teaching assistant whenever required
- Be guided by course notes from the previous semesters from senior students
- Work with peers to solve problems, discuss with friends

4.1.3 Private study

- Review lecture material and textbook
- Perform model tests and run computer program by yourself

4.2 ASSESSMENT

- Course credit hour plus one (In this course 3+1 = 4) quizzes will be taken to check if you are following the lectures attentively to check the basic knowledge
- Midterm exam and final exam will contain comprehensive numerical computations to assess complete understanding
- Assignments will be given for solving problems using specific methods that provide a complete experience of numerical computations
- In-class exams will be taken on programming language to check code developing ability for practical problems

4.3 EVALUATION:

Distribution of numerical scores		
Class attendance	5%	
Assignments	10%	
Quizzes	20%	Best 3 out of 4 will be counted
In-Class Exams, Weekly assignment, and Final assignment (MATLAB)	20%	
Midterm I	20%	One hour
Final Exam	25%	One hour thirty minutes

4.4 GRADING POLICY:

Generally, NSU grading policy will be followed. However, minor deviation is still possible depending on the situation.

4.5 EXAM POLICY:

No makeup for quiz and in-class exam is possible. MAKE UP for MID-TERM OR FINAL EXAM WILL BE ARRANGED UNLESS AN ABSOLUTELY UNAVOIDABLE VALID REASON FOR ABSENCE IS FOUND. For such unavoidable circumstances, written explanation of the situation must be submitted before the exam. If any class test or mid-term exam cannot be held on the due date, the exam will be automatically shifted to the very next available class, unless otherwise announced.

5 LECTURE SCHEDULE

***** One Day = 1.5 lecture hours, Total 22 lecture = 33 lecture hours

Day	*Material covered*	*Textbook Chapter*
Day-1	Introduction to Numerical Analysis	
Day-2	Error analysis, Significant digits, Accuracy and Precision	Chapter 3
Day-3	Solutions of systems of linear algebraic equations (Cramer's rule, Graphical method, Gauss-Elimination)	Chapter 9
Day -4	Solutions of systems of linear algebraic equations (Gauss-Elimination, Gauss-Jordan)	Chapter 9
Day-5	**Quiz 1** + Solutions of systems of linear equations (Gauss-Jordan, Gauss-Seidel)	Chapter 9
Day-6	Solutions of systems of linear equations (LU Decomposition)	Chapter 10
Day-7	Curve-fitting by least squares	Chapter 17
Day-8	Curve-fitting by least squares	Chapter 17
Day-9	**Quiz 2** + Finite difference	Chapter 23
Day-10	Finite difference + Review	Chapter 23
	Mid Term Exam	
Day-11	Finite difference	Chapter 23
Day-12	Finite difference	Chapter 23
Day-13	Interpolation	Chapter 18
Day-14	**Quiz 3** + Introduction to programming languages (MATLAB features and uses, Basic syntax)	Provided Material
Day-15	Matrix and Arrays in MATLAB	Provided Material
Day 16	MATLAB Commands and Variables	Provided Material
Day-17	MATLAB Decision making and loop types	Provided Material
Day-18	Functions and plotting in MATLAB	Provided Material
Day-19	MATLAB code for solving system of linear equations	Provided Material
Day-20	**Quiz 4** + Numerical integration (Trapezoidal rule, Simpson's rule)	Chapter 21

Day-21	Numerical integration (Gaussian Quadrature)	Chapter 21
Day-22	MATLAB code for Numerical differentiation and integration	Provided Material
	Last Class Review	

6 CODE OF CONDUCT

- It is highly requested to maintain discipline in the class like not to be late, refrain from making noise during lecture time, not to leave the class early.
- Adopting unfair means in the exams will be considered as a serious crime and the student shall be placed to the university disciplinary committee.
- All materials should be neat and clear, and demonstrate professionalism
- Direct duplication of the work of another is a big offense
- Paraphrasing another person's work with very minor changes keeping the meaning is also plagiarism