CE 30: **Algorithms and Problem Solving** (3 units)
(Numerical Analysis)

Language: English

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consultation hours: by appointment, F312 (regular consultation hours to be announced)

Course website: *http://www.geocities.com/lui_agustin/ce30*

1. Course Description

This course aims to equip students with numerical methods and algorithms that can be used to solve various science and engineering problems. The topics include error analysis, matrices, finding roots of equations, curve fitting, and numerical integration and differentiation. This course involves computer programming in C/C++.

Prerequisite: CE 21, CE 22, MA 21

2. Textbook

[Kreyszig] Erwin Kreyszig: *Advanced Engineering Mathematics*, 8th ed, 1999, Chap 17-19.

3. Course Outline and Timeframe

Course outline (follows the outline in [Kreyszig]):

- Numerical Methods in General
  - Introduction
  - Solution of Equations by Iteration
  - Interpolation
  - Splines
  - Numerical Integration and Differentiation
- Numerical Methods in Linear Algebra
  - Linear Systems: Gauss Elimination
  - Linear Systems: LU-Factorization
  - Linear Systems: Solution by Iteration
  - Curve Fitting: Method of Least Squares
  - Matrix Eigenvalues
- Numerical Methods for Differential Equations
  - Methods for First-Order Differential Equations
  - Multistep Methods
  - Methods for Systems and Higher Order Equations
  - Methods for Elliptic Partial Differential Equations

CE 30 Timetable, 2nd Semester, 2005-2006

Week		Monday	Tuesday	Thursday
1	Nov		15 start of classes	17
2			22	24
3			29	
3	Dec			1
4			6	8 CE 30 holiday
5			13	15
6			20 CE 30 holiday	
7	Jan			5
8			10	12
9			17	19
10		23 4 pm: Project 1 due	Jan 24 - 26 Evaluation of Project 1	
12			31	
				2
			7	9
13			14	16 CE 30 holiday
14			21	23
15			28	
15	Mar			2
16			7	9
17			14	16
18		20 4 pm: Project 2 due	Mar 21, 23 Evaluation of Project 2	

Adjustments to the timetable will be made as needed.

4. Course Requirements and Grading System

The course requires two projects and active participation in learning the required material.

4.1. Projects

Two programming projects shall be required. Projects may be done individually, or in groups of two or three. Students may propose alternative projects to those assigned, and work out the detailed specifications with the instructor. This may be done any time before the project is due, but alternative projects remain due at the same time the original projects are due. Each project shall be graded over 100 points as shall be indicated on the specifications for the project.

4.2. Participation

Each student must be actively involved in learning the subject matter both inside and outside the classroom.

Participation credits are given for acts that show participation in the course. Participation demerits are given when students fail to meet expectations, show an unwillingness to participate in class activities or make management and conduct of the course difficult or inefficient.

Each student may earn at most 5 participation credits on a given calendar day. On the other hand, each student may be given at most 5 participation demerits on a given calendar day.

Students earn participation credits for acts and circumstances similar to the following:

* presenting and discussing assigned material in class
* sharing insights on subject matter being discussed
* suggestions for improving the course
* asking questions that encourage discussion
* coming prepared and properly attired for consultation during consultation hours
* contributions to discussion on the mailing list
* conducting and attending special sessions (sessions must be announced in class; summary of proceedings must be submitted afterwards)
* identification and presentation of opensource software tools relevant to the course

Participation demerits are given for acts and circumstances similar to the following:

* coming late to class
* disturbing class discussion
* delaying class discussion
* inability to discuss assigned homework
* unwillingness to participate in class activities
* working on other subjects during class hours
* reading material unrelated to the course during class hours
* misuse of computers and other equipment
* failure to show up for scheduled consultation

A student's participation grade shall be computed as

$$Par = max\left(P_{min}, min\left(P_{max}, P_{min} + \frac{P_{cred} - P_{dem}}{M}\left(P_{max} - P_{min} \right) \right) \right)$$

where

P_{cred} is the sum of all participation credits earned by the student,
P_{dem} is the sum of all participation demerits earned by the student,
M is the maximum value of P_{cred} over all students in the class,
P_{min} is set to 0, but may be incremented in integral steps according to the instructor's discretion, and
P_{max} is set to 20, but may be decremented in integral steps according to the instructor's discretion.

P_{min} may be incremented whenever the instructor feels that the level of participation of all students in a class is of such quality so that a minimum score higher than 0 could be guaranteed to all. P_{max} is decremented whenever the instructor feels that the level of participation of all students in a class is so low so that the maximum allowable score for participation should be set at less than 20. P_{min} and P_{max} may be increased or decreased by at most 2 in a given calendar week. The instructor shall guarantee that the difference P_{max} - P_{min} is always positive.

4.3. Grades

The class standing (CS) is computed as

$$CS = 0.40\ P1 + 0.40\ P2 + Par$$

where

P1 is the grade for project 1, P2 is the grade for project 2, and
Par is the participation grade in the range [0,20].

The final grade (FG) will be determined from the class standing (CS) as follows:

FG =	F	if $CS < 50$,
	D	if $50 \leq CS < 60$,
	C	if $60 \leq CS < 69$,
	C+	if $69 \leq CS < 77$,
	B	if $77 \leq CS < 86$,
	B+	if $86 \leq CS < 92$,
	A	if $92 \leq CS$.

The instructor has the prerogative of giving students higher grades than those determined from the class standing. This may be based on various considerations including, but not limited to, perfect attendance in classes, active participation in the class and mailing list, and attitude toward the course.

5. Class Policies

5.1. Projects

Programming projects shall be done in C/C++.

Projects shall be submitted directly to the instructor. Students should sign up for project evaluation when they submit their projects. As a minimum, students should submit on diskette or on CD the complete source code of their project and a copy of the executable file. The executable file submitted should not have to be run from within the integrated development environment of a compiler. Students shall also be required to submit a hardcopy of the complete source code. A project is not considered submitted unless soft and hard copies have all been submitted.

Each project shall be graded over 100 points as shall be indicated on the specifications for the project.

Projects submitted late shall be penalized at the rate of 1 point per hour or fraction thereof that the project is late. Students who show up late for project evaluation shall be penalized 10 points. The project grade shall be 0 if the penalties incurred exceed the points earned.

Soft copies of late projects may be submitted by email at times when physical submission is impossible, such as night time or holidays. They are considered submitted at the time the email is received (not at the time the email was sent) provided that required soft and hard copies are subsequently submitted by 11 am of the earliest possible school day following the email submission, otherwise penalties continue to accumulate as if there were no email submission.

Students who submit projects on diskettes or CDs containing viruses, Trojan horses or any form of malicious code shall be given a grade of 0 for the given projects.

5.2. Attendance

Students are required to attend all classes.

The usual practice shall be for attendance to be checked soon after the official start of class. Students who arrive in class while attendance is being checked shall be considered present. Attendance may be checked at any time during class, any number of times. Absence from class at any time attendance is checked shall be considered a cut. No definite grace period is required after the official start of class before attendance is checked.

Students who arrive after attendance has been checked shall be barred from class. Those who insist on staying shall be considered absent, and shall be given participation demerits. Students who have exceeded the allowed number of cuts shall be given a grade of W, and shall be barred from class for the rest of the semester.

Dean's listers are not allowed unlimited cuts.

5.3. Attire

Students are expected to dress decently and appropriately. Students wearing inappropriate attire shall be barred from class and shall not be allowed to consult with the instructor.

Shorts and skirts that are too short are not appropriate attire. These shall be considered too short if the person would be touching skin rather than cloth when standing up with hands hanging down.

The recommended footwear shall be closed-toed shoes. The minimum requirement shall be that footware be supported at the back of the heel. Slippers and similar footwear that are unsupported at the back of the heel are not appropriate attire. For the purpose of this policy, slippers shall be defined to be footwear that are unheeled, and unsupported at the back of the heel.

5.4. Language

This is an English language course. All oral presentations shall be in English. All documents submitted shall be in English.

6. Mailing List

A mailing list shall be established for the course for any useful purpose it might serve. Membership in the mailing list is not a requirement of the course. However, students who do not join the mailing list deprive themselves of a means of earning participation credits.

7. Projects

Project 1:

CE 30 Programming Exercise 101
Least Mean Squares Fit for Sinusoids

Develop and implement an algorithm to determine the values of the parameters A, B, C and D that provide the least mean square error fit for the curve

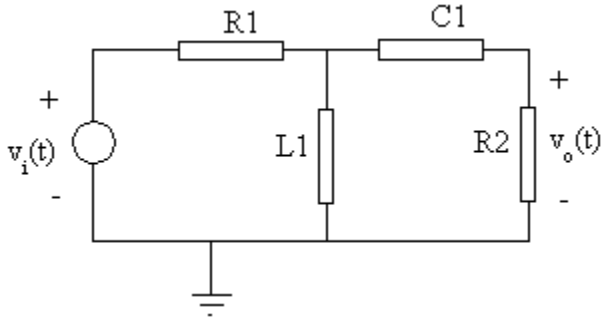
$$y = A + B \sin (2 \pi C x + D)$$

on a set of (x,y) data obtained from XYDAT files.
(Detailed specifications to follow)

Project 2:

CE 30 Programming Exercise 102
Circuit Simulation

Use an algorithm for the numerical solution of systems of differential equations in order to implement a simulator for the circuit shown.



(Detailed specifications to follow)