College of Engineering and Computer Science
Mechanical Engineering Department
Mechanical Engineering 209
Programming for Mechanical Engineers

Spring 2017 Number: 15832 Instructor: Larry Caretto

California State University
Northridge

Course Outline

Catalog Description

Corequisite: Math 150A. Basic programming concepts, implemented with Visual Basic for Applications (VBA), with an emphasis on engineering problem solving. Topics include the use of flowcharts, variable types, the Excel/VBA environment, decision and looping structures, and program debugging.

Instruction information	
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Course Information	
Course number	15832
Class hours	Tuesday and Thursday 12:00 to 1:25 pm
Class location	Jacaranda 1592

Expanded Description

This course introduces programming concepts and applications using the VBA (Visual Basic for Applications) language.

Text and references

Text: Steven C. Chapra, *Introduction to VBA for Excel* (second edition), Prentice-Hall (Pearson), 2010.

Reference: John Walkenbach, *Excel VBA Programming for Dummies*, Wiley, 2015.

Course Objectives and Conduct

Course Objectives – As a result of taking this course students should be able to

- do basic operations on Excel worksheets: navigating the Excel interface, entering data and formulas, using worksheet functions, formatting cells and text, plotting charts, and printing worksheets
- use the help system to find information on other Excel tools that you can use in your spreadsheets such as data validation, data tables, conditional formatting, range names, auditing formulas and goal seek
- write simple programs in VBA that can be used as user defined functions (UDF) or macros for Excel spreadsheets
- use the VBA editor to create programs that interface with the worksheet
- write code that declares and uses different variable types: long, double, date, string and Boolean
- create statements that do arithmetic calculations in correct order of precedence
- construct logical expressions and use them in if statements and loops
- construct logical and count-controlled loops
- use one- and two-dimensional arrays and be able to transfer arrays between the worksheet and VBA array variables

Relation to program outcomes – As part of the accreditation process, the BS degree program in mechanical engineering has a set of outcomes that students should achieve by the time that they graduate. This course is designed to contribute to the following program outcomes for the BSME degree program: (1) the ability to apply knowledge of mathematics, science and engineering, (10) a knowledge of contemporary issues, and (11) an ability to use techniques and skills of modern engineering tools.

Class Participation – Learning computer programming is difficult for most students and it can only be mastered by practice. Your learning in this course will be a combination of textbook material, laboratory exercises, lecture material and in-class discussion. Your active participation in class exercises and discussion is essential to helping you learn the subject matter.

Class sessions – Students are expected to attend each class and spend the complete time in each laboratory session. In addition, students will spend a significant amount of time outside of the lecture and laboratory developing their algorithms into code and preparing their assignments for submission. If you do not do this, you will not be able to complete your laboratory assignments in the time available. The laboratory sessions provide you with the main opportunity to get help from the instructor and from your classmates.

Grading – Your grade in this course will be based on five in-class, 30-minute quizzes, six programming assignments, a midterm, a programming exam and a final. The programming assignments will prepare you for questions on the course examinations and quizzes. The assignments, quizzes and exams will be weighted as follows in computing the final grade:

Quizzes (5)	20%
Programming Assignments (6)	20%
Midterm Examination	15%
Programming Examination	20%
Final	25%

The translation of a final numerical score into a letter grade rests solely on the judgment of the instructor. The following criteria will be used for letter grades:

- A: Student knows almost all the course material and is able to apply it to new programming tasks.
- B: Student satisfies one, but not both, of the conditions for an A grade.
- C: Student knows all the fundamentals of the course and can apply this knowledge to routine programming tasks.
- D: Student has learned some course material but is not able to apply all the fundamental points of the course.
- F: Student has failed to demonstrate knowledge of the course material beyond a minimal level.

Plus/minus grading will be used in this course. A plus grade indicates that the criterion for a given grade has been clearly met, but the student performance does not begin to approach the requirements for the next highest grade. A minus grade is given when the student performance does not quite meet the requirements for the grade, but the criterion for the next lower grade has been substantially exceeded.

There will be no make-up exams or quizzes. Students who miss the midterm will have their grade for the missed midterm based on their relative performance on the final exam. Students who do not take the final will receive an F in the course. Students who are unable to take the final for valid reasons (sickness, death, *etc.*) **must request, in writing,** an incomplete grade in the course. (University regulations do not allow an instructor to assign an incomplete grade without a signed request by the student.)

Plagiarism vs*. Collaboration* – Students often work together on assignments. This collaboration is helpful and encouraged. By working together, each of you can improve your learning of the subject. It is important that you ask anyone who helps you, including the instructor, why they tell you to write a particular line or lines in your code. Unless you understand why you are writing some line of code, you are not learning.

In this course two students may collaborate on programming assignments and prepare only one submission for grading. Students who do this are expected to contribute equally to the final written

submission and to work together on all parts of the assignment so that they understand all parts of the assignment.

There is a difference between working together to learn the material and copying someone else's work (either from other students or from some web site) and passing it off as your own. In this course, you are expected to submit work that you have done yourself (or, for programming assignments with one other student.) Submitting another person's work as your own is a violation of academic standards and University regulations. It is unethical behavior for people working in engineering and science or studying to work in these fields. Each student must submit his or her own work to pass the course.

Students who copy programs from some other source and submit them, as their own work will receive a zero grade for the assignment. Where two or more students submit nearly identical programs, each student involved will receive a zero grade for the assignment. Any student who does this more than once will receive an F grade in the course.

Identical solutions on exams, indicating copying, will result in an F grade in the course for both students involved. Students who are found cheating by submission of identical assignments or any other observations will be referred to the Office of the Dean of Students for disciplinary action.

Late assignments – There will be two deadline dates for assignments. Assignments that are not submitted by the first date may be submitted by the second date with a penalty of 30% of the maximum grade. No assignments will be accepted after the second date.

Add-drop policy – Students are expected to be familiar with the University regulations for adding and dropping classes. Students who find that they do not have enough time to prepare for this class or whose performance on the initial quizzes is poor should drop the class within the appropriate deadline. (See http://www.csun.edu/anr/soc/adjsched.html for campus policies; for Spring 2017, the last day to drop a class without prior approval for a significant reason is February 10.) Students who do not complete the course work and do not withdraw from the class will receive a grade of WU, denoting an unsatisfactory withdrawal. Such grades count the same as an F grade in the computation of students' grade point averages.

Changes – Students are responsible for all changes to this outline announced in class.

Schedule of lecture topics

The "Reading" column below shows the assigned page numbers in the required text by Chapra.

Date	Lecture Topic	Tasks	Reading
January 24	Introduction to (or review of) Excel. Overview of Excel commands and use for spreadsheet design.		
January 26	Use of various Excel commands including, functions, plotting, formatting, *etc.*		
January 31	Specific Excel topics: data validation, range names, generating a two-way table, other Excel procedures.		
February 2	Introduction to VBA via generation of macros. The macro recorder, the VBA editor, editing programs generated by the macro editor.	**Quiz 1**	1-18
February 7	VBA programming basics. Creating a module. Windows in the VBA editor. Data types and declaration. Use of Option Explicit for strong typing.	**Program Assign-ment 1 Due**	20-29
February 9	Functions and subs. Declaring variables in functions and subs. Simple example of function and sub.		75-82
February 14	Statements used to assign values to a variable. Operators and operator precedence. Arithmetic, relational, logical and string operators.		30-45
February 16	Exercises in writing statements. Why a replacement (variable assignment) statement is not the same as an equation.		

Date	Lecture Topic	Tasks	Reading
February 21	Introduction to writing VBA functions. How to transfer information from the worksheet to the VBA function.		45-52
February 23	Introduction to writing VBA subs. Use of statements like range("A1").value to get data from worksheet to VBA subs.	**Quiz 2**	
February 28	Introduction to program debugging via the VBA Debug tool. Basic controls of program execution for debugging.	**Program Assign-ment 2 Due**	65-73
March 2	More on debugging: use of breakpoints and step-by-step commands. Observing values of variables during program execution by hovering and different debug windows.		
March 7	Selection statement for program control. Construction of logical expressions and their use in if statements and if-elseif structures.		109-123
March 9	Practice in writing if statements. Use of select case statements as an optional approach to program choice.		
March 14	User-defined functions for calculations from with any cell. Equivalent use of same functions within VBA code. Calling functions from the worksheet and other VBA procedures.	**Quiz 3**	
March 16	Passing arguments to functions and subs by value and by reference. Use of functions as subs.	**Program Assign-ment 3 Due**	
March 21	**Spring Break No class**		
March 23	**Spring Break No class**		
March 28	Introduction to looping. Looping concept: repeating the same operations with different data. Conditional and count-controlled loops.		128-137
March 30	VBA use of For loop, Do While loop and Do-Loop-Until loops. Examples and results. Analyzing and debugging execution of looping code.		
April 4	Review for midterm.		
April 6	**Midterm exam**		
April 11	Review looping. Choosing the kinds of loops to use for a particular calculation. Multiple loops.		
April 13	Overview of VBA objects and object code.		54-64
April 18	Introduction to arrays. Basic concept of array as a set of data or a subscripted mathematical variable. One-dimensional and two-dimensional arrays. Higher dimensional arrays.	**Program Assign-ment 4 Due**	141-152
April 20	Array declaration. Default initial array index is zero. Use of OPTION BASIS statement to set default initial array index to one. Arrays in count-controlled loops.	**Quiz 4**	
April 25	Passing arrays into functions and subs. Passing worksheet ranges into VBA as arrays. Use of the variant data type to strip away other range properties.	**Program Assign-ment 5 Due**	
April 27	Returning array results to worksheet. Returning one-dimensional VBA arrays to the two-dimensional worksheet.		
May 2	Writing programs with arrays	**Quiz 5**	
May 4	Debugging programs with arrays.		

Date	Lecture Topic	Tasks	Reading
May 9	Final review day. Overview of all operations with worksheet and VBA. Preparation for programming exam. Review of course material for final.	**Program Assign-ment 6 Due**	
May 11	**Programming Exam**		
May 18	**Final Exam 12:45 – 2:45 pm**		

References for VBA

See the course web site http://www.csun.edu/~lcaretto/me209/sites.htm for references including a printable list of references.