FRSC 689: Computer Programming for Natural Resources Applications
SYLLABUS and TENTATIVE SCHEDULE

Instructors:	Dr. Marian Eriksson	Dr. R. Srinivasan
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	Office Hours: TBA	Office Hours: TBA

Lecture/Lab: Centeq;   B214

Section	Meeting Time
600	TBA

Prerequisites: Approval of the instructors.

Justification and Objectives

This course is intended for graduate students with little or no previous experience with formal programming languages.

Students entering graduate-level remote sensing and GIS programs come from a wide array of undergraduate programs, many of which require only the completion of a computer literacy course for graduation. To make maximum use of any type of analytical software often requires that the user "think outside of the box" – that they coax programs into doing things that the designers of the program had not thought of or had chosen not to include. Also, even when the desired functionality is included with the software, it is often necessary to perform the same task on many different objects. The ability to automate such repetitious and tedious tasks often results in substantial increases in efficiency (and coincident decrease in tedium and boredom).

A macro is a program, often a very small program, that is written to run from within a larger program package. At this time Visual Basic for Applications (VBA) is the macro programming language of choice in a large number of program packages. This includes most Microsoft products, ArcGIS, and ERDAS. In time, this may change and other languages may come to dominate. That won't matter–once you have learned one programming language it is easy to pick up another because the concepts are the same in all languages.

The course is organized in two distinct portions. In the first portion, lasting 9 weeks, you will learn the fundamentals of VB programming. This portion will be taught by Dr. Eriksson. In the second portion, lasting 5 weeks, you will apply and extend the VB programming skills learned in the first to writing macros for ArcGIS. The second portion of the course will be taught by Dr. Srinivasan.

First Portion

Since Excel is unquestionably the most widely used analytical tool, since most undergrads are introduced Excel, and since it lends itself well to the development of an understanding of Visual Basic programming concepts and techniques, most of the first portion of the course will use Visual Basic for Excel Applications. You will leave this portion of the course with an understanding of the VBA environment, top-down programming, data types, arrays, subroutines and functions, conditional branching, looping, branching to other subroutines and functions, a general understanding of forms and the use of objects. You will also be introduced to objects, the use of flow charts and debugging tools.

Second Portion

Visual Basic macro programming in ESRI ArcGIS: ArcGIS is a powerful and an 'expandable' software, meaning that its capacity/purpose can be extended and/or customized based on user's interests. Just as you have seen in the MS-Excel, the macro environment is available in the ArcGIS to help users extend and/or customize some of the applications in the ArcGIS. VBA offers the same tools as Visual Basic (VB) but provides them in an existing application—in this case the core ArcGIS applications, ArcMap and ArcCatalog, and the ArcGIS extension, ArcScene. VBA is built into each of these applications. In this second portion of the course, you will be acquainted with how VBA programming language is used to perform user-specific operations within the ArcGIS. Also, you will complete other user-specific customization of the ArcGIS Control tools and write VBA codes to extend its applications. At the end of the course, you will be well informed about programming in the macro environment in general and the applications of VBA both in the MS-Excel and the ESRI's ArcGIS in particular.

Homework: Weekly homework assignments will be made for the first portion of the course. These will be a combination of short tasks intended to learn programming concepts and somewhat longer tasks intended to develop programming competency. Each assignment will count equally toward the final grade unless noted otherwise. For the second portion there will be two mini projects and one larger project.

Exams: There will be two exams, each covering the material from the preceding third of the course. The exams will be comprehensive only to the extent that material in the second builds on material from the first and material in Dr. Srinivasan's third of the course will build on material covered in Dr. Eriksson portion.

Textbooks*: Bradley, J. C. and A. C. Millspaugh. 2003. *Programming in Visual Basic .Net*. McGraw-Hill, 600pp.

*Tentative. We are still evaluating books. Of those books evaluated to date, even though this book is for .Net, it has the best discussion of programming basics.

Supplemental Material Supplemental reading materials will be posted on the course web sites.

Web sites   tapc.tamu.edu (1st portion) and www-ssl.tamu.edu/university courses (2nd portion)

Grading: **1st Portion**:   66%

            Breakdown:

Homework 1-8 (4% each)	32%
Homework 9 "Project"	8%
First on-line exam	10%
2nd on-line exam	16%

       2nd Portion: 34%

            Breakdown:

Two mini projects (7% each)	14%
Main project	20%

TENTATIVE LECTURE SCHEDULE

Lecture	Topic(s)
1a	Housekeeping; Hello World / elements; Review Excel
1b	Review Excel: data types; classes of functions esp. string, logical, lookup; record macro; review Access – basics
2a/b	Basics: Top-down; memory & variables; naming conventions & rules; reserved words; operators; assignment statements; data types; strong vs weak typing / Option Explicit; functions (MsgBox); VBE esp. Immediate Window; Step-Into/Run/Break points; objects (general) / Debug.Print, Application/Range/Cells (Cells will be the primary form of I/O for the next 4½ -5weeks).
3a/b	Strings & string functions; order of precedence; record macro – Cell properties; using With; vb/mso/xl constants (Object Browser); If and Select blocks; conditions & logical functions; flow charting basics;
4a/b	Events; Error-trapping & debugging; For / Do while / Do until; initializing; accumulators; flow-charting; nested Ifs; nested loops; Exit. May take 2 lectures, if so then at the expense of scripting or stand-alone topics. Assign to read about DMD *before* next lecture.
5a	Larger example (DMD for polygon area). On-line exam assigned, due within 48 hours.
5b	User-defined functions; calling other subs; modify DMD; named & optional arguments; recursive functions; scope/lifetime of variables; idea of garbage collection. Modify DMD to (1) call function, subs and (2) use optional parameter to start with (x,y).
6a	Arrays & the Array function; Option Base; ReDim (since they will have been working with Cells, this should be straight-forward). Modify DMD to use arrays; Other kinds of statements
6b	Using objects; forms & controls; finding objects; the Object Browser; Active-X & Addins – info only, very general; Word, Access, Arc basic objects
7a	Working with objects: charts, drawing, etc.
7b	General I/O; working with files; Database functions / link to Access;
8a	Review HTML & intro client-side scripting
8b	Intro server-side scripting; database connections; Excel as client; Excel as server
9a	Intro stand-alone programming. Take home practical assigned.
9b	Creating a stand-alone program: simple but complete (through the creation of a setup.exe file). Assign on-line exam to be taken after HW 9 is complete.
xx	HW9 & on-line exam due in week 10.

10a	Review ArcGIS: applications and components (arcMap, arcCatalog, arcInfo)
10b	Review VBA in ArcGIS: familiarization with data types and classes of functions (application, document, map, layer and feature layer); types of built-in controls
11a	Intro to customizing ArcGIS: addition of custom controls such as Commands, Tools, Editbox, Combobox and Menu to the ArcMap interface; customize ArcCatalog
11b	Create new UIToolControl: customize with new Control Tools (create new toolbars and menus); define variables; add VBA codes to command the functionality of the Control Tools
12a/b	Using ArcObjects with VBA; reading ArcObjects OMD's class: define interfaces, properties and methods for an object; reading ArcObjects OMD's interfaces: methods of communication with an object, defining logical groups of methods and properties; reading ArcObjects OMD's properties and methods: set/read properties and perform actions
13a	ArcObjects OMD's class relationships: inheritance, instantiation, composition and association; Navigating OMD: MxDocument class, Map class and Query Layer class
13b	Testing an object reference (type of variable, typeOf object, nothing); programming tips
14a/b	Intro to stand-alone VB programming; creating a stand-alone simple VB programs to run using ArcGIS resources. Working with ArcCatalog: registering dll and Add-Ins

TENTATIVE EXAM SCHEDULE:

First on-line exam:	Week 5
Second on-line exam:	Week 9

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The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe that you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities in Room 126 of the Koldus Building, or 845-1637.

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Work hard !   Have a good semester!