ELA118: Spreadsheet Programming for ChEs – Excel's VBA

Lecture 1 – Introduction to VBA, Recording Macros

- Set up Excel's options for use of VBA
- Become familiar with the Visual Basic Editor
- Create modules
- Record a simple macro
- Record and edit a more complicated macro to automate creation of an engineering graph

Lecture 2 – Creating and Debugging User-Defined Functions

- Develop user-defined functions (UDFs) to implement engineering formulas
- Use VBA's debugging tools
- Include decisional logic in program code in UDFs
- Program UDFs with range inputs
- Create array functions
- Integrate a family of UDFs into an Excel Add-In

Lecture 3 – Communicating between the Spreadsheet and VBA

- Access and manipulate spreadsheet data from VBA
- Transfer data to and from the spreadsheet with VBA
- Use range names in favor of cell addresses in VBA code
- Deal with blocks of cells and arrays in VBA
- Create and format worksheets from VBA

Lecture 4 – Object-Oriented Programming

- Explore Excel's Object Hierarchy with the Object Browser and Object Model Reference
- Reference objects and object collections in VBA code
- Become familiar with object properties, methods and events
- Learn VBA's object-oriented programming structures
- Use Range objects in VBA code

Lecture 5 – Data Types and Arrays

- Learn VBA's different data types
- Use the Option Explicit declaration to require variable declaration
- Understand the concept of scope of variables
- Track variable type and value with the Locals Window
- Learn about VBA arrays
- Understand how to use cell ranges as arguments to functions
- Build arrays in VBA from user input

Lecture 6 – Numerical Methods

- Implement table interpolation with a user-defined function
- Use the bisection method to solve a nonlinear algebraic equation
- Program the Golden Section search method to find the extremum of a nonlinear function
- Solve systems of ordinary differential equations using the RKG method with an array UDF
- Automate the Regression program in Excel's Analysis Toolbox
- Create VBA code to automate Excel's Goal Seek and Solver features

Lecture 7 – Structured and Modular Programming

- Learn how to organize VBA applications in modular form
- Write VBA code to invoke Subs and Function
- Develop an array UDF to compute an ideal multicomponent bubble point
- Become familiar with the various VBA selection and repetition structures

Lecture 8 – Event Handlers

- Learn about events in Excel
- Develop code examples for event handlers
- Know what workbook-level events are
- Understand event handlers for worksheet-level events
- See how the OnTime, OnKey and On Error event handlers are programmed

Lecture 9 – Message Boxes and Input Boxes

- Learn the details of the MsgBox function
- Program the InputBox function and method
- Practice using on-sheet controls including command buttons and check boxes

Lecture 10 – Introducing UserForms

- Understand design considerations for UserForms
- Learn the rudiments of creating UserForms
- Program event handlers for UserForms and their controls
- Become familiar with all the UserForm controls and their uses

Lecture 11 – Developing VBA Applications

- Consider a detailed, capstone example for creation of an Excel/VBA application
- Design an Excel/VBA application including UserForm organization and layout
- Create UserForms for the application based on the design
- Generate the VBA code for the application's event handlers and module
- Test and validate the Excel/VBA application

Lecture 12 – Interfacing with Other Programs

- Learn how to access compiled programs from Excel via VBA with a Fortran example
- See how Matlab's Excel Link toolbox is employed as an Excel Add-In to interface to Matlab via VBA
- Observe the Mathcad worksheet embedded into the Excel application and how VBA is used to interconnect the two
- Learn how Excel can be used to acquire data from and transmit data to a process simulation via VBA programming with an AspenTech Hysys example