A. Linwood Holton Governor's School

INTRODUCTION TO

ENGINEERING METHODS and COMPUTER PROGRAMMING

Course Syllabus

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Office Hours: by appointment

Course Description Summary: This course will introduce, through the use of high level computer languages, the fundamentals of structured computer programming and problem solving techniques to students with little or no programming experience. Students will learn solution methodologies applicable to a broad range of technical and non-technical fields as well as how to "think algorithmically". Students will construct original computer code as well as use packaged software in their exploration of learning software based problem-solving techniques. Students will begin learning program design through the use of the Python and Processing languages.

Solution strategies will emphasize problem solving. However, the material covered will also allow the student to use programming as a means of self-expression.

The course is all inclusive. Thus, technical fundamentals outside of most students' backgrounds, which are required for class problems, will be covered as part of the course. Coverage may be outside of scheduled class time and include video content and secondary web site materials.

Prerequisites: Algebra II

Required Text and Materials:

Python Programming: An Introduction to Computer Science (third edition)
by John Zelle;
Think Python: How to Think Like a Computer Scientist
from Allen B. Downey (*on-line interactive version*);
Learning Processing (Second edition)
by Daniel Shiffman;
The Nature of Code
by Daniel Shiffman (on-line version)

Students must also have access to a desktop/laptop type computer, with high speed internet connection, outside of daily class time.

Dual Enrollment Credit:

Introduction to Engineering Methods (EGR 125), 3 credit hours; and
Introduction to Computer Programming (EGR 127), 3 credit hours

College credit is issued through one of four community colleges based on the location of the high school the student attends: *Virginia Highlands Community College*, *Mountain Empire Community College*, *Southwest Virginia Community College*, or *Wytheville Community College*.

[Please note that both dual enrollment classes span the entire academic program. Dual enrollment credit for EGR 125 & EGR 127 is earned concurrently. Therefore, for example, academic year students must complete both semesters of the course to receive any dual enrollment credit.]

Course Objectives: This course is designed to introduce the fundamental techniques of computational problem solving. The course will provide an understanding of the abilities and limitations of computation. At the conclusion of the course, students will have the ability to write object oriented code to accomplish useful goals.

Instructional Methods: The course is taught in a "real time"/synchronous lecture/programming Q&A session format via the Internet. To aid in programing concept discussion, class pages will be used at Piazza (https*://piazza.com*). Also, break-out groups will be used in class for problem solving collaboration and concept clarification.

To facilitate a student's successful understanding of the concepts and methods required for programming and engineering analysis, additional study aids will be available to the student outside of the class. These include, but are not limited to

- Videos illustrating language use and general course related concepts;
- Supplemental technical documents and handouts;
- Computer based tutorials: instructional tutorials in the form of video link with slides;
- Numerous web sites, which offer supporting and additional material

Some course material will be made available through the Governor's School Engineering Methods & Computer Programming web site. Course material will also be made available through the HGS Virtual School site

Evaluation Methods: Grades will be based upon:

- Class participation;
- Homework programming assignments;
- In class programming assignments;
- Pop quizzes, if any;
- Exams;
- Projects and other supplementary assignments; and
- Comprehensive mid-term and final exam(s).

Typically grades are determined weighted:

- Programming assignments: 40-70%
- Mid-Term and other Exam: 10-25%
- Comprehensive final exam(s) 25% - 35% of academic period grade
- Class participation: up to 15%
- Course programming projects 10-25%

Grade weight given to assignments (e.g., programming projects) will be announced at the time of their assignment.

A grade assignment scale in accordance with the *Governor's School Student Handbook* (i.e., 90-100: A, 80-90: B, etc.), both numerical and letter, is used. Averaged grades reported for any one grading period may be scaled upward at the discretion of the instructor. Grades for any semester and/or academic year period, which may also be scaled upward when reported, are determined using actual grades earned by the student. There is no "extra credit."

Grading of Programming Assignments: Each programming problem in a programming problem assignment, unless otherwise announced prior to the assignment due date, will be graded on a ten (10) point scale as follows:

- *Excellent* (10/10) — Program solves problem for all cases. 8, 9 may indicate efficiency problems, awkward code, lack of comments, etc.
- *Good* (7/10) — Program solves problem for most cases, but has flaws. 5, 6, 7 may be used to indicate severity of flaws.
- *Marginal* (4/10) — Student made attempts to solve most problems, but missed some key conceptual ideas that make their program incorrect. Major portions of problem are unsolved or not attempted. Significant debugging would be required to make program work.
- *Unacceptable* (2/10) — Program does not even run without significant editing. Problem completely misunderstood. Solution completely incorrect.
- *Not Submitted* (0/10) — Self-explanatory.

Attendance: Students are required to attend all classes and to be "in class" at the scheduled daily start time. Regarding the physical location of a student when attending the class, the attendance policies and expectations of the student's home school are to be followed. While "in class", students are expected to be attentive and prepared to talk if called upon. Students observed conducting any activity not in keeping with the current class discussion or explicitly permitted by the instructor during that day's class will be immediately dismissed from class for the day, not permitted to return, and receive a grade of zero "for the day". [The grade of zero will be averaged with the student's assignment grades as if an additional 60 point programming assignment were given with a grade of zero for the phantom programming assignment.]

It is not the responsibility of the instructor to remember a student's schedule.

Students can be excused from class and/or class obligations by the Governor's School Engineering Methods & Computer Programming instructor. A student's local school officials cannot excuse a student from any Governor's School assessment or course work requirement.

Scheduled Exams: Exam times and dates are announced well in advance both in class as well as in the Outlook calendar for the class. Students may access the Outlook calendar through their Governor's School email account. Students must contact the instructor well in advance of any exam date which may be missed due to an scheduled absence. An alternate exam time and/or date, which must be before the announced scheduled time, will be scheduled at the discretion of the instructor. No "make-up" exam after a scheduled exam date will be given. Students failing to obtain an alternate date well in advance of their absence will receive a grade of zero for the missed exam. In exceptional cases, and at the discretion of the instructor, other assessment grades may be averaged and the average grade so calculated subsequently used to replace a missed assessment.

Assignment Submission: All assignments must be submitted to the instructor no later than the announced and/or posted due date and time. **No late submissions will be accepted.** Submission method will be announced at the time of assignment. If email is used as the method for assignment submission, the time stamp placed on the email by the Governor's School's email server at the time of delivery to the instructor's email address shall be solely used to determine if a student's work has been submitted on or before the due date and time.

An excused absence does not relieve the student from their obligation to submit work by the announced due date. Also, short-term technical failures at any location do not provide justification for the acceptance of late submissions. (For exceptional cases, the course instructor will consider the waiver of the due date and time provided the instructor is consulted as soon as possible. What constitutes an "*exceptional case"* is determined solely by the instructor.)

To develop professional work practices and to facilitate grading of work and its return, all hand written assignment work – homework and/or exams - must meet the guidelines listed in the course *Assignment Submission Guide,* which is posted on the Governor's School's Engineering Methods & Computer Programming course web site. Work not meeting all of the requirements detailed in the *Assignment Submission Guide* will not be graded, resulting in a recorded grade of zero (0) for the work.

Graded work is returned to the student in the PDF file format as an attachment to an email, which is sent to the student's Governor's School email account.

Course Content:

Topics to be covered include …

- Object-oriented programming (using Python and Processing)
    - Primitive types and class types
    - Functions, including recursion
    - Basic statements: assignment, if-statements, loops, blocks, function calls
    - Objects and classes, including subclasses, inheritance, and polymorphism
    - Abstraction
    - Sequences, dictionaries, and arrays
    - Testing and debugging
    - Program development; stepwise refinement (top-down design) and object-oriented design
    - Basic searching and sorting algorithms
    - A model of execution
    - Programming style considerations
    - Algorithm Efficiency
    - File Processing
    - Recursion
- Python Windows based graphics
- Processing (Java) Windows based graphical programming

Course Learning Outcomes:

Upon completion of the course a successful student will be able to …

- Describe the roll computation plays in solving problems
- Demonstrate effective programming style based on established standards, practices, and guidelines
- Apply computational thinking problem-solving skills to new problems of interest in the individual's future academic discipline
- Design and write substantial – 500 to 1500 lines – computer programs with minimal guidance
- Have a conceptual understanding of modular top down design and object oriented programming and be able to employee same in computer program design and construction.
- Explain and/or analyze the efficiency of algorithms.
- Be able to explain and construct code for classical numerical methods/topics such as Newton's Method, quadrature, etc.
- Construct sorting and search codes with knowledge of sorting and search algorithms using, in some cases, recursion.
- Develop graphic based programs incorporating real-time user interaction.

Code of Conduct: Student must observe the course *academic honesty policy*. A copy of the policy is distributed to all students at the beginning of the term. A copy of the document is also available at the course web site: EM&CP.

All forms of academic dishonesty (also known as academic misconduct or cheating) will be prosecuted. In keeping with school policy, the minimum penalty will be no credit for the work involved. The instructor refers matters of academic dishonesty to the Governor's School's Director for disposition of outcome. Nevertheless, the course instructor reserves the right to take independent action including, but not limited to, imposition of a failing grade for a grading period and/or for the course itself.

Policy Applicability: The policy stated in this syllabus as to exam dates, problem assignment submission requirements, academic honesty, etc. supersedes any student's home school policy.

Information & Instructions for Individuals with Disabilities: Students may request academic accommodations for identified disabilities through Holton Governor's School's (HGS) main office, which is located on the second floor of the Southwest Virginia Higher Education Center on the Virginia Highlands Community College campus (276- 619-4326). Administrative staff will evaluate the request, consult with appropriate officials from the student's home school, and develop a plan that outlines necessary and reasonable accommodations to be followed. All correspondence will be kept confidential.

Emergency Statement: In the event of a major interruption of technological connectivity or actual emergency affecting the student's school or the offices of Linwood Holton Governor's School, class meeting times or schedules, assignment deadlines, and grading schemes are subject to

changes that may include alternative delivery methods, alternative methods of interaction with the instructor, alternate class materials, changes to class membership, a revised attendance policy; a revised semester calendar and/or grading scheme, etc..

For more general information about plans for dealing with such catastrophic events or emergencies, please consult the following resources:

- The student's home school's Emergency Notification and Response Plan
- The Holton Governor's School web site - http://www.hgs.k12.va.us – where instructions will be posted in the event of an emergency.

Should such a situation arise, HGS's Director will work closely with the appropriate school division and college personnel to resolve it as soon as possible. Students will be contacted through available forms of communication and given specific directions as to how they will proceed to complete their course work, how timelines will be adjusted, etc.

Contact ALHGS:

Linwood Holton Governor's School
P.O. Box 1987
Abingdon, Virginia 24210
(276) 619-4326

Community College Syllabus Material

The content below is required to be included in this document by the community college listed.

Mountain Empire Community College

Core Competencies:

This course satisfies the following core competencies: Communication, Critical Thinking, Information Literacy, Quantitative Reasoning, and Scientific Reasoning.