COURSE SYLLABUS

1 ECE 2160 - C++, Algorithms & Data Structures

2 Meeting Information

3 credits, 3 contact hours (Three 50-minute lectures, weekly)

a. **Section 001:**
Lecture: MWF 8:30 am - 9:20 am, **Tolentine 427A**

b. **Section 002:**
Lecture: MWF 9:35 am - 10:25 am, **Tolentine 427A**

3 Course Instructor(s), TA(s)

a. **Section 001:**

Class Instructor:	Dr. Sarvesh Kulkarni
Office Hours:	MW 10:30 am - 12:30 pm, or by appt.

TA(s):
Ms. Prathibha Keshavamurthy
pkeshava@villanova.edu

Office Hours:	MW 12:30 - 1:30 pm, Tue 12:30 - 1:00, 3:30 - 4:00 pm, or by appt.
Room:	Drosdick 307

b. **Section 002:**

Class Instructor:	Dr. Sarvesh Kulkarni
Office Hours:	MW 10:30 am - 12:30 pm, or by appt.

TA(s):
Ms. Prathibha Keshavamurthy
pkeshava@villanova.edu

Office Hours:	MW 12:30 - 1:30 pm, Tue 12:30 - 1:00, 3:30 - 4:00 pm, or by appt.
Room:	Drosdick 307

4 Textbook

ECE 2160: C++, Algorithms & Data Structures, zyBooks, 2024. REQUIRED.

a. **Other Supplemental Materials:** Slides and notes posted on Blackboard

b. **Misc. Notes:**
If you have opted-in to Villanova's Textbook Access Program, the interactive course textbook may be accessed by following the instructions HERE at no extra charge.

If you have opted out of Villanova's Textbook Access Program, then please **subscribe** to the course e-textbook here (Cost: $89):

(a) Sign in or create an account at learn.zybooks.com
(b) Enter the zyBook code: **VILLANOVAECE2160KulkarniFall2024**
(c) Subscribe

5 Specific Course Information

a. **Catalog Description**
C++ classes access rules, inheritance, friends, abstract classes, templates, passing parameters by value, by reference, polymorphism in functions and operators, static and dynamic binding, searching, sorting; pointer implementation of lists, stacks, queues, trees, analysis of algorithms; P, NP, Undecidable problems.

b. **Prerequisites:** ECE 1260 and ECE 1261; **Co-requisites:** ECE 2161

c. Required for BS CpE

6 Learning Objectives

a. On conclusion of this course, students will: 1. Acquire good programming habits and be proficient in C++ programming using object oriented techniques, 2. Recognize the importance of, and select appropriate application-specific data structures in programs, 3. Be able to write modular programs using the mechanisms of class inheritance and composition to implement various user-defined data structures in C++ using low-level pointer constructs. 4. Learn the techniques of code-reuse, 5. Analyze the asymptotic time complexity of an algorithm and understand its impact on execution time, 6. And thus, select/design computationally efficient algorithms that result in computationally efficient programs.

b.

ABET Student Outcomes														
1a	1b	2a	2b	2c	2d	3	4a	4b	4c	5	6a	6b	7a	7b
X	X												X	X

The above student outcomes are defined by the Accreditation Board for Engineering and Technology (ABET) as:

1a. an ability to identify and formulate complex engineering problems by applying principles of engineering, science, and mathematics

1b. an ability to solve complex engineering problems by applying principles of engineering, science, and mathematics

7a. an ability to acquire new knowledge as needed, using appropriate learning strategies

7b. an ability to apply new knowledge as needed, using appropriate learning strategies

7 List of Covered Topics

1. Introduction to C++: Abstract data types, classes, members, objects, inheritance, templates, polymorphism and pointers
2. Asymptotic complexity and running time analysis of algorithms
3. Pointer and dynamic variables: Concepts and usage of pointers, pointer parameters to/from functions, pointer arithmetic, pointer-style array representation, dynamic memory allocation & deallocation
4. Lists, Stacks, Queues and Binary Trees: Implementation using arrays, pointers, and operations (insertion, deletion, search) on them
5. Sorting Algorithms: Bubble sort, Merge Sort
6. If time permits: Basic concepts in the hardness and computability of problems - P, NP, NP-Complete and Undecidable classes of problems

8 Tentative Schedule

Tentative schedules for all sections follow. Be sure to refer to the schedule for your specific section, if more than one is provided.

Tentative Schedule for **All Sections**

Week #	Dates	Topics of Study
1	8/26 – 8/30	Review of C; program development concepts and pitfalls
2	9/2 – 9/6	**9/2: Labor Day break;** Review of C (contd.); The compilation process; software life cycle models; ADTs, classes
3	9/9 – 9/13	Class members and object instantiation; Functions: outside and within classes, default parameters, function overloading; Constructors: with and without default parameters
4	9/16 – 9/20	Quiz 1 - Mon, 9/16 Destructors; operator overloading; precedence & associativity of operators; templates for classes & functions
5	9/23 – 9/27	Program organization; member access specifiers; Friend functions & classes; inheritance: class hierarchies
6	9/30 – 10/4	Quiz 2 - Mon 9/30 Member access rules; static & dynamic function binding; abstract and concrete classes; Pointer & dynamic variables: concepts & syntax
7	10/7 – 10/11	Pointers: visualization, manipulation, passing pointers to/from functions; arrays in pointer notation; allocating and de-allocating dynamic arrays Midterm i.e. Exam I - Fri, 10/11
8	10/14 – 10/18	**Fall break**
9	10/21 – 10/25	Asymptotic time complexity of algorithms: Big-O, Big-Ω and Big-Θ, & solved examples
10	10/28 – 11/1	Asymptotic time complexity: solved examples (contd.); pointer-implementation of singly-linked lists (SLLs)
11	11/4 – 11/8	Quiz 3 - Mon, 11/4; SLLs (contd.)
12	11/11 – 11/15	Doubly-linked Lists (DLLs); circular lists; stacks; queues
13	11/18 – 11/22	Quiz 4 - Mon, 11/18; Binary trees & binary search trees (BSTs)
14	11/25 – 11/29	Exam II - Mon, 11/25; **11/{27-29}: Thanksgiving break**
15	12/2 – 12/6	BST operations: BST operations: breadth-first & depth-first traversals, node insertion, node deletion
16	12/9 – 12/11	P, NP and Undecidable problem classes; topics review on final class day (Wed, 12/11); **Tue, 12/10: Deemed Fri class day**
17	12/16	12/16: Comprehensive Final Examination (Optional) from 11:30 am - 2:00 pm in Driscoll 246

9 Grading Policy

Homework: 35% weightage ... 20% for pre-class, 15% for after-class
Quizzes: four quizzes, 20% total weightage
Two examinations: 45% weightage total
Comprehensive Final Exam (Optional): 45% weightage (This score replaces the above two examination scores ONLY IF you score higher)

A single final composite score (out of 100) will be computed from the above weighted components. This composite score will be converted to a letter grade as follows: A student with a composite score of 90+ will receive an A grade while a student with a composite score of less than 50 will receive an F grade. A grading curve will apply to all scores between 50 and 90 that reflects a class average of B.

Before the reading day, you will be assigned a "provisional" letter grade for the course. If you are satisfied with your provisional letter grade, you do not need to take the comprehensive final examination. Your provisional grade will then automatically become your final grade. However, should you wish to improve your final grade, you must expressly inform the instructor of your intent to take the comprehensive final examination. Your final letter grade will reflect the higher of these two grades: 1. your provisional letter grade, and 2. your letter grade computed by replacing the two examinations with the comprehensive final examination. Thus, your final letter grade can never be lower than your provisional letter grade.

10 HW Assignment and Laboratory Report Submission Policy

Class:
There are two kinds of HW assignments: pre-class HW, and post-class HW. Pre-class HW assessment will be online and automatic - you need to only complete your reading assignments and answer questions posed by the online textbook BEFORE class. Post-class HW must be completed using the software development kit (SDK) provided, and the files must be uploaded to "Blackboard" (the course management software) before the posted deadline. For HW assignments that do not require programming, you may handwrite your solutions and either hand them in, or upload a single scanned pdf file before the posted deadline. Late HW assignments will be assessed a 10% penalty per day, up to the posted cut-off date. After the cut-off date, HW assignments WILL NOT be accepted. If you cannot fully finish your HW, turn in your incomplete work to receive partial credit.

11 Attendance Policy

General Rules

The full version of the official Villanova class attendance policy is posted at https://live-villanova-catalog.cleancatalog.io/class-attendance, but the main points are as follows.

A roll call will not be taken at the start of each class. However, you are expected to attend ALL classes unless officially excused. Since examination questions will be based on the material taught in class and the prescribed reading from the course textbook, missing classes will put you at a severe disadvantage. So, attend all classes, and be sure to take notes attentively.

Whenever possible, students should inform the instructor if they plan to be late or absent from class. In all cases, documentation is required to petition for *excused* absences to the Associate Dean for Student and Strategic Programs, Dr. Stephen Jones. The excused absence form is posted at: https://forms.office.com/r/1RsFK4qhBk.

Excused absences do not count towards a failure in the course for first year students. Absence from class does not release the student from assigned work. Students who miss an in-class obligation such as an exam, a presentation, etc., due to an excused absence will not be penalized - the instructor may offer a make-up test, arrange an alternative time for a presentation, exempt a student from the assignment, or provide another arrangement. In the case of illness or injury, the form must be submitted within 24 hours of missing a class. The University's list of excused absences for all students includes the following:

1. Participation in NCAA athletic competitions
2. Participation in special academic events such as: conferences, field trips, project competitions, etc., and in official university business such as student representatives attending meetings related to university governance
3. Attendance at significant events of the immediate family such as: funerals, weddings, etc.
4. Religious holidays - see the University's policy on Religious Holidays
5. College-approved participation in placement activities such as: job interviews, graduate school interviews, job fairs
6. Legally required absence such as: jury duty, court appearance, short-term military service
7. Documented serious illness or disability

Personal Days

Personal Days are NOT allotted for laboratory sessions and courses that meet once a week. For all other courses that meet at least twice a week, students are entitled to excused absences for any reason that may contribute to their personal wellness. The following rules apply.

Students must advise the instructor by email *before* class of their intent to utilize a Personal Day as the reason for their absence. A Personal Day will not be approved retroactively. Students may, but are not required, to provide additional information regarding their absence. A Personal Day does not grant an automatic extension for items due. Students remain responsible for all assignments, exams, presentations, etc. due on that date. The instructor may apply her/his discretion on a case-by-case basis to determine whether an extension on a deliverable item is appropriate.

For classes that meet thrice a week (50 mins $\times$ 3), TWO personal days are allowed in the semester. These personal days may not be used ...

1. on consecutive class days
2. in the same week
3. immediately preceding or following a University holiday or break period, and
4. on days when exams, presentations or other major assignments are scheduled.

For classes that meet twice a week (75 mins $\times$ 2), ONE personal day is allowed in the semester. This personal day may not be used ...

1. immediately preceding or following a University holiday or break period, and
2. on days when exams, presentations or other major assignments are scheduled.

12 Examination Policy

The College of Engineering has adopted the following general examination guidelines:

1. Students must arrive before the start of the examination. Under exceptional circumstances a student may need to arrive late, but he/she can enter the examination room no later than five (5) minutes after the start of the exam.
2. Cell phones must be turned off until the student exits the examination room.
3. The official Villanova class attendance policy must be followed when requesting excuses for absences or lateness to an examination.
4. Each student must write and sign the following statement, "I have neither given nor received any unauthorized assistance in the completion of this examination."
5. For online examinations, the instructor may implement video proctoring or other measures to ensure academic integrity. For consent purposes, the instructor will inform students in advance if (s)he plans to use any form of video-proctoring and whether the examination will be recorded.

13 Academic Integrity Policy

The College of Engineering is committed to creating an environment of academic integrity and ethical decision-making that we hope is reflected in the actions of our students and graduates. As Villanova students, integrity is central to the University mission. As engineers, our code of conduct requires us to place honor and integrity at the forefront of everything we do. As engineering students, it is expected that you will begin to adopt these values and instill them into your work habits. Students violating the academic integrity policy will receive a zero on that assignment or exam and the violation will be reported to the Associate Dean for Academic Affairs. The University's academic integrity policy can be found on the following web page:
https://live-villanova-catalog.cleancatalog.io/academic-integrity-0.

14 Use of Artificial Intelligence

The use of AI-generated textual content, mathematical analyses or program code is NOT permitted in this course. If questions arise about the authorship of your work, you may be asked to verify your authorship by either submitting to an oral examination/assessment by the instructor, or by submitting evidence of your work in the form of drafts, notes and version histories.

15 Adherence to the Student Code of Conduct

Students are expected to act in a professional and respectful manner to their fellow students, faculty, and staff. Students should become acquainted with and understand the responsibilities set forth in the Student Handbook, especially those in the sections on Policy and Regulations. Adherence to university regulations is expected and required for successful completion of the program of studies. Enforcement within the classroom of policies regarding classroom behavior is the responsibility of the faculty member. All other discipline problems are to be referred to the Dean of Students.

16 Inclusive Classroom

This classroom is a place where you will be treated with respect; we welcome individuals of all ages, backgrounds, beliefs, ethnicities, gender, gender identities and expressions, sexual orientation, and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment to allow all among us to learn and flourish.

17 Students with Disabilities

It is the policy of the university to make reasonable academic accommodations for qualified individuals with disabilities. If you are a person with a disability (non-physical) please register with the office of Learning Support Services (LSS) by emailing Learning.support.services@villanova.edu or by phoning 610-519-5176 as soon as possible. Registration is *required* in order to receive accommodations. In addition, please contact the instructor during office hours in order to make the appropriate arrangements.

The Office of Disability Services (ODS) collaborates with students, faculty, staff, and community members to create diverse learning environments that are usable, equitable, inclusive and sustainable. The ODS provides Villanova University students with physical the necessary support to successfully complete their education and participate in activities available to all students. If you have a diagnosed disability and plan to utilize academic accommodations, please contact and register with Gregory Hannah, advisor to students with disabilities at 610-519-3209 or visit the office on the second floor of the Connelly Center.

18 Tutoring Services

Villanova's tutoring services include The Writing Center, The Learner's Studio, and The Center for Speaking and Presentation. These services are offered free of charge to students. Drop in as-needed or book a regular weekly session to supercharge your academic success. Sessions can be 30 or 60 minutes in length.

Register for an account and book sessions in advance at villanova.mywconline.com. If you don't see your class listed, request a tutor for a missing subject at: tutorrequest.villanova.edu For more information, contact Juliana Struder at juliana.studer@villanova.edu or at 610-519-5862.

19 Online Expectations

Some or all sessions of this class may be recorded for educational purposes and for later playback. In order to foster a professional environment, please wear appropriate clothes, refrain from eating, mute your microphone when you are not talking so as to eliminate background noise, and select an appropriate setting free of distractions. You may turn off your webcam for privacy reasons unless explicitly instructed not to do so by the instructor (such as during the conduct of online examinations).

20 Electronics Policy

The use of electronic devices, such as phones, laptops, tablets, calculators, etc., during class is generally allowed, unless their use causes a disturbance to others. During examinations, the use of any electronic device is prohibited, unless it is expressly authorized by the instructor.

Students are prohibited from making any audio or visual recordings (including taking photographs) of lectures, discussions, or other classroom activities, unless a student (1) has written permission in advance from the instructor, or (2) is permitted to record under terms and conditions as approved by the University's Office of Disability Services or Learning Support Services. Students who have received approval to record classes as an academic accommodation must provide supporting documentation from the Office of Disability Services or Learning Support Services in advance of any recording. Students may use authorized recordings only for the purposes of individual study in the course, and may not disseminate or share them with a wider audience without explicit permission.

21 Copyright Policy

The materials used in Villanova University courses ("Course Materials") generally represent the intellectual property of course instructors, third parties and/or the university which may not be disseminated or reproduced in any form for public distribution (e.g., sale, exchange, etc.) without the written permission of the course instructor. Course materials include all written or electronic documents and materials, including syllabi, current and past examination questions/answers, and presentations such as lectures, videos, slides, etc., provided by a course instructor. Course materials may only be used by students enrolled in the course for academic (course-related) purposes.

Published course readings (book chapters, articles, reports, etc.) available in "Blackboard" are copyrighted materials. These works are made available to students through licensed databases or fair use. They are protected by copyright law, and may not be further disseminated or reproduced in any form for distribution (e.g. uploading to websites, sale, exchange, etc.) without the permission of the copyright owner.

Follow these links for more information on Intellectual Property, Copyright, and Computer Acceptable Use.

22 Professorial Duties

It is important to note that teaching is one of the many duties that professors perform as part of their job responsibilities. In addition to teaching, professors perform research, advise graduate students, edit journals and review journal articles, serve on committees for the university and professional societies, travel to conferences to remain abreast of current developments and to present their results... to name just a few commitments.