

INSTRUCTOR:

Alfred Menezes, Email: ajmenezes@uwaterloo.ca
Office hours: will be posted on LEARN and on the assignments.

TEACHING ASSISTANTS: (Office hours will be posted on LEARN and on the assignments)
Emma Jones (Head TA), Email: EmmaJonesUW@gmail.com

WEB PAGE: learn.uwaterloo.ca The course web page will contain video lectures; slides; assignments and solutions; practice problems; handouts; and quizzes. *You are not permitted to share any course material (assignments, solutions, exams, slides, videos) with anyone.*

LECTURES: Video lectures for the week will be posted on LEARN by 7:00 pm each Sunday.

PIAZZA: piazza.com/uwaterloo.ca/winter2023/co331, **PASSWORD:**

You are encouraged to use Piazza to ask questions about the video lectures and to discuss the course material. *You may ask for general clarification about assignment questions. However, please do not discuss solutions to assignment questions on Piazza, or make posts that reveal part of a solution.* In particular, please do not ask for hints of Pizza. Instead, please see the instructor or one of the TAs during their office hours or make a private post on Piazza.

TEXT: Lectures and the slides will follow the book *An Introduction to Error Correcting Codes with Applications*, by S.A. Vanstone and P.C. van Oorschot. It is recommended that you do *not* purchase the book. The book is available for free download from <https://tinyurl.com/C0331textbook>

PREREQUISITES: Math 135, Math 136, and one of Math 235/239.

SYLLABUS: We will cover some algebraic methods for devising error-correcting codes. These codes are used, for example, in satellite broadcasts, CD/DVD/Blu-ray players, memory chips, two-dimensional bar codes (including QR codes), and digital video broadcasting. The mathematical ingredients for the course include linear algebra, groups, rings, ideals, and finite fields. The necessary abstract algebra will be introduced as needed.

LEARNING OUTCOMES: On successful completion of this course, students will be able to:

1. Demonstrate a fundamental understanding of the binary symmetric channel, decoding strategies, and the challenges with designing good codes;
2. Construct codes, and devise efficient encoding and decoding algorithms for them as a means of gaining exposure to the applications of linear algebra and abstract algebra;
3. Analyze the properties of major families of algebraic codes including linear codes, Hamming codes, Golay codes, cyclic codes, BCH codes, and Reed-Solomon codes.

EVALUATION

Assignments (5):	35%	Due dates: 11:59 pm on Jan 25, Feb 8, Mar 1, Mar 22, Apr 10.
Quizzes (2) :	15%	Feb 15, Mar 15
Final exam:	50%	Date: TBD.

Notes:

1. Assignments will be submitted using Crowdmark.
2. *Assignments are not weighted equally.* The total marks received on assignments will be added at the end of the course.
3. The two quizzes, which are in lieu of a midterm test, will be administered **online** on LEARN. The questions will be of the following kind: multiple choice, True/False, fill in the blanks, short answers. In either case, they will be **open book** (but not open internet). Further instructions will be provided later in the course.
4. The date for the final exam will be set by the Registrar's Office. The exam will be **in-person** and will be **closed-book**.
5. There is no requirement to pass the final exam in order to pass the course.

COURSE POLICIES

1. **Office hours.** Please make use of TA and instructor office hours and Piazza throughout the semester. The TA office hours should be used only for assistance with assignment questions. You can use my office hours for assignment questions as well as for questions about the lecture material.
2. **Email queries.** Please restrict your email queries to questions that have short (e.g., YES/NO) answers. Questions that may have longer answers are best handled during office hours or on Piazza.
3. **Collaboration on assignments.**

One or two questions on each assignment will permit no collaboration of any kind; more details will be provided on the assignment. For the remaining questions, you are welcome (and encouraged) to collaborate on assignments in groups of size at most 5 with other students presently enrolled in CO 331. However, *solutions must be written up by yourself.* If you do collaborate, you must *acknowledge your collaborators* in the write-up for each problem. You are *not* permitted to solicit help from websites such as Course Hero and Chegg, online discussion groups, or solutions from previous offerings of the course.

4. **Assignment deadlines.** The material for each assignment problem will be covered well in advance of the assignment due date, so you will have adequate time to work on assignment problems. Late assignments will *not* be accepted except in *very* special circumstances (usually a documented illness of a serious nature). High workloads because of midterms and assignments in other courses will *not* qualify as a special circumstance.
5. **Grade appeals.** If you have any concerns with the marking of assignment questions, please send me an email together with a *clear and detailed* description of your appeal(s). If your marked assignment was returned to you on day X , then you should email appeals to me by the end of day $X + 7$ (and no later). Solutions to assignments will be posted on the course website shortly after the assignment submission deadline.
6. **Academic integrity.** In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check <https://uwaterloo.ca/academic-integrity/> for more information.]

7. **Grievance.** A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4, <http://tinyurl.com/UWPolicy70>. When in doubt please be certain to contact the department's administrative assistant who will provide further assistance.
8. **Discipline.** A student is expected to know what constitutes academic integrity [check uwaterloo.ca/academic-integrity/] to avoid committing an academic offence, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate Associate Dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline, <http://tinyurl.com/UWPolicy71>. For typical penalties check Guidelines for the Assessment of Penalties, <http://tinyurl.com/UWPenalties>.
9. **Appeals.** A decision made or penalty imposed under Policy 70 (Student Petitions and Grievances) (other than a petition) or Policy 71 (Student Discipline) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 (Student Appeals) <http://tinyurl.com/UWpolicy72>.
10. **Note for students with disabilities.** AccessAbility Services, located in Needles Hall, Room 1401 (<http://uwaterloo.ca/accessability-services/>), collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with AccessAbility Services at the beginning of each academic term.
11. **Mental Health.** If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support.

On-campus Resources

- Campus Wellness: <https://uwaterloo.ca/campus-wellness/>
- Counselling Services: counselling.services@uwaterloo.ca / 519-888-4567 ext 32655 / Needles Hall North 2nd floor, (NH 2401)
- MATES: one-to-one peer support program offered by Federation of Students (FEDS) and Counselling Services: mates@uwaterloo.ca
- Health Services service: located across the creek from Student Life Centre, 519-888-4096.

Off-campus Resources

- Good2Talk (24/7): Free confidential help line for post-secondary students. Phone: 1-866-925-5454
 - Here 24/7: Mental Health and Crisis Service Team. Phone: 1-844-437-3247
 - OK2BME: set of support services for lesbian, gay, bisexual, transgender or questioning teens in Waterloo. Phone: 519-884-0000 extension 213
12. **Diversity.** It is our intent that students from all diverse backgrounds and perspectives be well served by this course, and that students' learning needs be addressed both in and out of class. We recognize the immense value of the diversity in identities, perspectives, and contributions that students bring, and the benefit it has on our educational environment. Your suggestions are encouraged and appreciated. Please let us know ways to improve the effectiveness of the course for you personally or for other students or student groups. In particular:

- We will gladly honour your request to address you by an alternate/preferred name or gender pronoun. Please advise us of this preference early in the semester so we may make appropriate changes to our records.
- We will honour your religious holidays and celebrations. Please inform us of these at the start of the course.
- We will follow AccessAbility Services guidelines and protocols on how to best support students with different learning needs.