

The University of Western Ontario
 Department of Statistical and Actuarial Sciences
ACTUARIAL SCIENCE 2553A
Mathematics of Finance -- 2022-23

Instructor	Section	Day/Time	Location	email	Office/Phone
Mr. S. Kopp	001 Tutorial	MWF – 3:30-4:30 M – 5:30-6:30	SH 3345 WSC 55	kopp@stats.uwo.ca	284 WSC; 661-2111 Ext 86288
Office Hours: Tuesdays 2:00 to 4:00 pm					

1. Prerequisites:

A minimum mark of 60% in Calculus 1501B, or a minimum mark of 85% in Calculus 1301B.

Anti-requisites:

Actuarial Science 2053

Students are advised that they are responsible to ensure that they possess the necessary prerequisites (or have written special permission) and that de-registration may occur at any time if they lack the prerequisite or have taken an antirequisite course.

2. Textbook:

“Financial Mathematics – Theory and Practice” by Robert Brown and Steve Kopp

- Either \$131.82 (soft-cover, coil-bound) **OR** ~~approximately \$110 (digital version only)~~; both available through the UWO bookstore (no digital version available this year)

3. Approximate Course Outline

Chapter 1 – The Time Value of Money (2 weeks)

- Accumulation and amount functions; effective rate of interest; accumulating and discounting with simple and compound interest; time periods; rate of discount; nominal rates of interest and discount; force of interest and discount; varying interest

Chapter 2 – Equivalence Equations (1 week)

- Equations of value; determining the length of time or rate of interest for an investment; treasury bills; real rate of interest

Chapter 3 – Simple Annuities (2 weeks)

- Annuity immediate; annuity-due; deferred and forborne annuities; determining the length of an annuity; determining the rate of return

Chapter 4 – Other Types of Annuities (2 weeks)

- Annuities payable more or less frequently than interest is compounded; perpetuities; continuous annuities; varying annuities

Chapter 5 – Repayment of Debts (2 weeks)

- Amortization schedules; determining the outstanding balance of a debt; sinking fund method of repaying a loan; refinancing a loan

Chapter 6 – Bonds (1.5 weeks)

- Bond prices on and between coupon dates; amortization of a bond, callable bonds, determining the rate of return

Chapter 7 – Rates of Return (1.5 weeks)

- Internal rate of return; net present value; dollar-weighted and time-weighted rates of interest; dividend discount model

Chapter 8 – Yield Curves (1 week)

- Term structure of interest rates; spot rates; forward rates; the yield curve

4. What are you going to be graded on?

(a) Assignments

There will be 3 assignments that are designed to give you an introduction to the **spreadsheet computer program of Excel**. They are due by 8 pm on the following dates:

1	Wednesday, October 5	3	Wednesday, November 23
2	Wednesday, October 26		

I am expecting to use GRADESCOPE for the assignments. That means you will need to upload your assignment to Gradescope by 8 pm on the dates given above (as opposed to handing in a paper copy of your work). More information about how to do that will be given on the course OWL site as we get closer to the due date of the first assignment.

The assignments will be available on the course web site 1 week before the due dates.

- **You will lose 20% for every day the assignment is late**
- Each assignment will contain a few computer Excel spreadsheet questions
- You will be given an account number to use the computers in room 256 WSC OR you can use your own computer at home and any spreadsheet you wish to use
- There will be study notes included with assignment 1 to help you get started on Excel.

For assignments, you are required to upload your own independent work. You may collaborate with other students, but you must write your assignment in your own words. The TA's marking the assignments will be instructed to look for assignments that appear to be identical and if found, ALL will receive a mark of zero.

(b) Tutorials

A tutorial hour has been set aside every Monday from 5:30 to 6:30 pm in room 55, Western Science Centre. FOUR of them will be used for tutorial TESTS (see below) and the rest will be used as a tutorial. There will be NO tutorial on October 10 (Thanksgiving) or October 31 (start of reading week). Some tutorials may be used as class time.

Tutorial Tests:

There will be 4 tutorial tests on the following dates:

1	Monday, September 26	3	Monday, November 14
2	Monday, October 17	4	Monday, November 28

- The tests will be one-hour closed book, consisting of written answer questions based on material taught since last test.
- If you miss a test, you will need to get your reason for missing the test approved by the Dean's Office in order to avoid getting a mark of ZERO. The weight of that test will be moved to the final exam.

(c) Final Exam:

The final exam will be scheduled for the December exam period. It will be a 3-hour exam closed book exam covering the whole term. It may be a combination of multiple choice and written answer questions OR it may be only written answer questions.

<p>Cellular phones, iPods, and other similar technology are <i>not</i> permitted in the exam room. This means that cellular phones, iPods, and other similar technology cannot be used as a timekeeper/clock, calculator, or for any other purpose</p>
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5. Evaluation:

	Marking Scheme
Assignments (3 of them)	8%
Tests (4 of them at 10.5% each)	42%
Final Exam	50%

6. Calculator

You will also need a pocket calculator for assignments, midterm and the final exam. **Only non-programmable calculators may be used for the midterm and final exam.** The following (SOA exam) models are strongly recommended:

Texas Instruments BA-35

BA II Plus or TI-30X II (memory must be cleared prior to start of exam)

TI-30X or TI-30Xa

7. Course OWL Web Page:

The web page will contain:

- Class notes.** Will be available before each class. This will save you time from having to write everything down during class time. Instead, you come to every class and add things that I write down in class (like solutions to examples) to your class notes.
- Solutions to the textbook exercises
- Old exams for you to practice (available about 2 weeks before the tests/final exam dates)
- Solutions to the tutorial tests
- Weekly updates and information about the course that you need to know

8. Course Accreditation

University Accreditation Program – Canadian Institute of Actuaries (CIA)

This course is accredited under the Canadian Institute of Actuaries (CIA) University Course Accreditation Program (UAP) for the 2022-23 academic year. Achievement of the established exemption grade in this course may qualify a student from exemptions from writing certain preliminary exams. **This is the last year of the CIA course accreditation program.**

Please note, a combination of this course, and Financial Modeling 2557B, is required to achieve an exemption for preliminary exam FM (min. of 75% in each course is required).

NEW: Program Accreditation by the CIA

If you are in 2nd or 3rd year of the Honours Specialization in Actuarial Science

If you graduate from with an HSP in Actuarial Science, this course will be one of the courses that you will take in your program that will allow you to be exempt from the preliminary exams of the Society of Actuaries (SOA). This is under the new **CIA program accreditation program**. If your plan is to become a fully qualified actuary working in Canada, then all you would need to do is graduate from your HSP in actuarial science. You would then be eligible for the CIA Capstone Exam. Taking and passing this exam, along with an online module and a practice education course, would make you eligible to become an ACIA (associate, Canadian Institute of Actuaries).

Major in Actuarial Science

If you are a student in a major in Actuarial Science, the CIA program accreditation program will not apply to you. If your plan is to become a fully qualified actuary, you will need to continue to write and pass the preliminary exams of the SOA. However, for 2022-23 this course is still accredited under the Canadian Institute of Actuaries (CIA) University Course Accreditation Program (UAP) for the 2022-23 academic year. Achievement of the established exemption grade in this course may qualify a student from exemptions from writing certain preliminary exams.

This is the last year of the CIA course accreditation program.

Please see the following link for full details:

<http://www.cia-ica.ca/membership/university-accreditation-program---home>

In addition to the university's internal policies on conduct, including academic misconduct, candidates pursuing credits for writing professional examinations shall also be subject to the **Code of Conduct and Ethics for Candidates in the CIA Education System** and the associated **Policy on Conduct and Ethics for Candidates in the CIA Education System**.

<https://www.cia-ica.ca/docs/default-source/2020/220065e.pdf>

9. COURSE OBJECTIVES

This course is intended to give you an introduction to the underlying formulas and theory regarding interest and interest rates and how they are used in financial calculations. Specifically, by the end of this course you will be able to perform the following calculations and understand the principles behind them:

1. Accumulate and discount a single sum of money at either a simple or compound rate of interest or at a rate of discount
2. Determine an effective rate of interest, given a rate of interest that is compounded more than once a year allowing you to compare various investments
3. Solve equations of value and recognize the time value of money
4. Accumulate and discount a series of payments made at regular intervals of time
5. Determine the rate of return on an investment
6. Determine the length of time that is required to yield a given rate of return
7. Accumulate and discount a series of payments where payments are made at regular intervals of time that differ from how frequently interest is compounded
8. Accumulate and discount a series of payments where the payments vary
9. Determine loan payments
10. Determine the outstanding balance of a loan using the amortization and sinking fund methods
11. Deal with interest that is compounded continuously and payments that are made continuously
12. Using discounted cash flow analysis and calculating internal rates of return to assist in making business decisions
13. Determining the rate of return of a fund when deposits and withdrawals are made
14. Calculating the duration, modified duration and convexity of a series of cash flows and be able to use it to approximate the change in the value of an financial asset
15. Understanding the spot rate, forward rate and how to calculate the price of a stock using the dividend discount model
16. Understanding the terminology of cash flow matching and immunization

Your success in this course will depend on attending classes on a regular basis, writing all four tutorial tests and, like any math course, working on the exercises in the textbook.

Success in any math based course (like this one) depends on keeping up with the work and not falling behind. It will be very difficult to “cram” at the last minute to write the tutorial tests and to study for final exam.

10. Student Absences

Academic Consideration for Student Absences

Students who experience an extenuating circumstance (illness, injury or other extenuating circumstance) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration through the following routes:

- (i) For medical absences, submitting a Student Medical Certificate (SMC) signed by a licensed medical or mental health practitioner to the Academic Counselling office of their Faculty of Registration.
- (ii) Submitting appropriate documentation for non-medical absences to the Academic Counselling office in their Faculty of Registration.

Note that in all cases, students are required to contact their instructors within 24 hours of the end of the period covered.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For the policy on Academic Consideration for Student Absences – Undergraduate Students in First Entry Programs, see:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf

and for the Student Medical Certificate (SMC), see:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at

<https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>

Absences from Examinations

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

11. Accommodation and Accessibility

Accommodation Policies

Students with disabilities work with Accessible Education (formerly SSD), which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf

12. Academic Policies

The website for Registrarial Services is <http://www.registrar.uwo.ca>

In accordance with policy,

https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf

the centrally administered e-mail account provided to students will be considered the individual’s official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

Computer-marked multiple-choice tests and exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

13. Support Services

Please visit the Science Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at (519) 661-2147 if you have any questions regarding accommodations.

Learning-skills counsellors at the Student Development Centre (<http://www.sdc.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to Mental Health@Western (<http://www.health.uwo.ca/mentalhealth>) for a complete list of options about how to obtain help.

Additional student-run support services are offered by the USC, <http://westernusc.ca/>