

The University of Western Ontario  
 Department of Statistical and Actuarial Sciences  
**ACTUARIAL SCIENCE 2553A**  
*Mathematics of Finance -- 2021-22*

Instructor	Section	Day/Time	Location	email	Office/Phone
Mr. S. Kopp	001 Tutorial	MWF – 9:30-10:30 M – 5:30-6:30	NCB 113 WSC 55	kopp@stats.uwo.ca	284 WSC; 661-2111 x86288
Office Hours: TBD					

**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 \$122.56 (soft-cover, coil-bound) **OR** \$102.81 (digital version only); both available through the UWO bookstore

**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 6	3	Wednesday, November 24
2	Thursday, October 28		

I am expecting to use GRADESCOPE for the assignments. That means you will need to upload your assignment to Gradescope by 6 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 Actuarial Science 2553A OWL web page approximately 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 11 (Thanksgiving) or November 1 (start of reading week).

##### Tutorial Tests:

There will be 4 tutorial tests on the following dates:

1	Monday, September 27	3	Monday, November 15
2	Monday, October 18	4	Monday, November 29

- 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 use an SRA (self-report) in order to avoid getting a mark of ZERO. If miss a test, 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, with emphasis on material covered since the midterm. It may be a combination of multiple choice and written answer questions OR it may be only written answer questions.

## 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:

1. **Class notes.** I am hoping to make my class notes available before each class (they may not be ready until the day before the class however). This will save you time from having to write everything down during class time. Instead, what you will need to do is come to every class and add things that I write down in class (like solutions to examples) to your class notes.
2. Solutions to the textbook exercises
3. Old exams for you to practice (available about 2 weeks before the midterm/final exam dates)
4. Solutions to the tutorial tests
5. Weekly updates and information about the course that you need to know

## 8. Course Accreditation

**This course is accredited under the Canadian Institute of Actuaries (CIA) University Accreditation Program (UAP) for the 2019-20 academic year. Achievement of the established exemption grade in this course may qualify a student from exemptions from writing certain preliminary exams.**

**Please note, a combination of this course, and Financial Modeling 2557B, is required to achieve an exemption for preliminary exam FM (minimum of 75% in each course is required). Please see the following link for full details:**

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

## **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 the mid-term and final exams.

## **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) Submitting a Self-Reported Absence (SRA) form provided that the conditions for submission are met. To be eligible for a Self-Reported Absence:
  - an absence must be no more than 48 hours
  - the assessments must be worth no more than 30% of the student's final grade
  - no more than two SRAs may be submitted during the Fall/Winter term
- (ii) 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.
- (iii) 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](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](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](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](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](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/>