

**The University of Western Ontario – Department of Statistical and Actuarial Sciences**  
**ACTUARIAL SCIENCE 2053**

*Mathematics for Financial Analysis -- 2024-25*

Instructor	Sec	Day/Time	Location	email	Office/Phone
Mr. Steve Kopp	001	MWF – 11:30- 12:20	WSC 55	kopp@uwo.ca	WSC 284 519-661-2111, ext 86288

**1. Pre-requisites**

Grade 12U calculus (or equivalent), PLUS one full university level course (or 2 half courses) from Mathematics, Applied Mathematics, Calculus, or Linear Algebra

**Anti-requisites:**

Actuarial Science 2553A

**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 anti-requisite course.**

**2. Textbooks (both are available in the UWO bookstore)**

- “Mathematics of Finance”, 9th Edition, by Brown-Kopp  
(softcover: \$122.35; e-book: \$89.00—99.00)
- Study note package (which contains chapters 8 to 12) (\$44.00)

**3. Course Outline (course is divided into 3 semesters):**

Text	Chapter	Topic
1. Textbook	1	Simple Interest and Simple Discount
	2	Compound Interest (skip section 2.10)
	3	Simple Annuities
	4	General and Other Annuities
2. Textbook	5	Repayment of Debts
	6	Bonds (skip Serial Bonds of section 6.7)
	7	Business Decisions, Capital Budgeting, Depreciation
	8	Fixed Income Investments
Study Note		
3. Study Note	9	Probability and Life Tables
	10	Life Annuities
	11	Life Insurance
	12	Life Insurance Expenses

**4. Midterm Exam 1**

**Wednesday, November 6, 2024 – 6 pm to 9 pm;** Chapters 1, 2, 3, 4

The format will be either multiple-choice questions, or written answer questions (TBA). A formula page will be provided for both tests. It will be CLOSED BOOK.

**5. Midterm Exam 2**

**Saturday, February 1, 2025 – 9 am to noon;** Chapters 5, 6, 7, 8

The format will be either multiple-choice questions, or written answer questions (TBA). A formula page will be provided for both tests. It will be CLOSED BOOK.

**NOTE:** If you miss either midterm exam, you will be required to write the make up exam. The dates of the make up exams have not yet been set, but will likely be in the evening of the following Thursday (more detail about missing an exam is given in section 12, on page 5).

## 6. Final Exam

**Scheduled for the final exam period – 3 hours**

Chapters 9, 10, 11, 12

The format will be either multiple-choice questions, or written answer questions (TBA). A formula page will be provided for both tests. It will be **CLOSED BOOK**.

You will also need a pocket calculator (non-programmable) for the tests and the exams.

**Note: There will not be a December exam.**

## 7. In-class Quizzes

There will be 8 (4 per term) short written answer question quizzes that will be given at the very start of class on the following **Wednesdays (except where noted)**:

1	September 25, 2024		5	January 22, 2025
2	October 9, 2024		6	February 26, 2025
3	<b>FRIDAY November 1, 2024</b>		7	March 12, 2025
4	November 27, 2024		8	March 26, 2025

- The quizzes will start right at the start of the class on the above dates and you will have 16 minutes to complete the assigned question(s) – **do NOT be late for class on these dates as you will NOT be given extra time (PLUS: if you arrive more than 5 minutes after the quiz has started, you will NOT be allowed to write the quiz)**
- The quizzes will consist of 2 questions (or perhaps 1 question with multiple parts) that will be based on material covered over the past 2-3 weeks of classes
- The quizzes will be out of 8 marks – you will get 2 marks just for signing your name and handing in a blank answer (note: this is NOT a bonus of 2 marks that everyone gets; it just means the minimum anyone can get on a quiz that they show up for is 2 out of 8)
- Only the best 6 out of the 8 quizzes will count towards your final mark
- **If you miss a quiz due to a health reason, that missed quiz will be one of the two that will not count towards your final mark** (there are NO make up quizzes)

**Cellular phones, iPods, and other similar technology are *not* 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

## NOTE

- There will be no class on Monday, September 30 (Truth and Reconciliation day)
- **Fall reading week:** October 14 to 18, 2024 (no classes)
- **Winter reading week:** February 17 to 21 (no classes)
- I will be away on Monday, October 28; there will be no in-person classes; instead I will be posting a video of the lecture on the course OWL site

## 8. Evaluation

	Original	If you do poorly on one exam		
Quizzes (best 6 of 8)	15%	15%	15%	15%
Midterm 1	28 1/3%	21%	32%	32%
Midterm 2	28 1/3%	32%	21%	32%
Final Exam	28 1/3%	32%	32%	21%

The marking scheme that gives the higher final mark will be the one used for that student.

## 9. Course Brightscope Web Page

The web page will contain:

1. A copy of this course outline
2. Copies of tests and exams from the previous year (with solutions)
3. Solutions to the exercises in the 9<sup>th</sup> edition of the textbook (as pdf files)
4. Weekly updates and information about the course that you need to know
5. **Daily class notes (which will be incomplete – to be filled in during the classes).**
6. Marks of quizzes and tests as they are marked.

## 10. Course Objectives

This course is not intended to make you financial geniuses or to suggest what investments or insurance products you should be buying.

Instead, the objective of this course is to show you how you can do many useful financial calculations yourself, using a calculator, pen and paper (the textbook also shows you how some of the calculations can be done using a computer spreadsheet, although we will not be doing this in class). Some of the calculations you will be able to do by the end of the course include:

1. Accumulating & discounting a single sum of money using either simple or compound interest
2. Accumulating & discounting a series of payments made at equal time intervals using compound interest
3. Calculating loan payments, including mortgage payments
4. Determining the rate of return on an investment
5. Determining the price of a bond or the rate of return on a bond
6. Understanding the yield curve and the risks involved with a fixed income investment

In the last part of the course you will be introduced to the fundamentals of financial calculations involving life contingencies. You will be able to:

1. Perform calculations involving probabilities of living or dying within a certain period of time
2. Calculate how much money you need at a certain age to purchase an annuity paying you a certain amount of money every year or every month for the rest of your life
3. Calculate the premium to be paid for a certain type of life insurance policy

Your ability to do all the above (and more) will be evaluated through written answer questions on the in-class quizzes and through a combination multiple choice/written answer questions on three exams.

# 11. APPROXIMATE Weekly Course Outline:

<b>Week – 2024</b>	<b>Section</b>	
Sept 9-13	Accumulating/discounting simple interest (section 1.1-1.2)	
Sept 16-20	Equations of value, partial payments, simple discount (section 1.3 to 1.5)	
Sept 23-27	Accumulating/discounting with compound interest, equivalent rates, fractional periods (section 2.1-2.4)	
<b>In-class Quiz #1 – Wed, September 25 at start of class</b>		
Oct 2-4, Oct 7	Determining the time and interest rate, equations of value, changing rates, other applications (section 2.5 to 2.8)	
<b>In-class Quiz #2 – Wed, October 9 at start of class</b>		
Oct 9-11	Ordinary annuities – accumulated value (section 3.1, 3.2)	
Oct 14-18	<b>FALL READING WEEK</b>	
Oct 21-25	Ordinary annuities – present value + other annuities (section 3.3, 3.4)	
Oct 28-Nov 1	Other annuities (section 3.4); Determining term/rate (sections 3.5, 3.6)	
<b>In-class Quiz #3 – FRIDAY, November 1 at start of class</b>		
Nov 4-8	General annuities, mortgages, Perpetuities, (section 4.1-4.2-4.3)	
<b>MIDTERM EXAM #1 – WEDNESDAY, November 6 – 6:00 to 9:00 pm</b>		
Nov 11-15	Varying annuities (section 4.4), Amortization (section 5.1)	
Nov 18-22	Outstanding balance, Refinancing, Sum of digits (section 5.2, 5.3, 5.4)	
Nov 25-29	Sinking Funds (5.5/5.6/5.7) Bonds–Purchase price (6.1/6.2)	
<b>In-class Quiz #4 – Wed, November 27 at start of class</b>		
Dec 2-6	Premium and Discount, Callable Bonds, Bonds bought between dates (section 6.3, 6.4, 6.5)	
<b>NO DECEMBER EXAM</b>		
<b>Week – 2025</b>		
Jan 6-10	Rate of return on a bond, other types of bonds (section 6.6, 6.7); Net present value, Internal rate of return, (section 7.1, 7.2)	
Jan 13-17	Dollar weighted and time weighted rates of return (section 7.3, 7.4) Capitalized Costs, Depreciation (section 7.5, 7.6);	
Jan 20-24	Fixed income investments, yield curve, forward interest rates (8.1, 8.2), Types of Risk (8.3)	
<b>In-class Quiz #5 – Wed, January 22 at start of class</b>		
Jan 27-31	Duration, convexity (sections 8.4 to 8.7)	
<b>MIDTERM EXAM #2 – Saturday, February 1 – 9:00 to noon</b>		
Feb 3-7	Probability, life tables probabilities (section 9.1 to 9.5)	
Feb 10-14	Expectation of life, select mortality (section 9.6, 9.7)	
Feb 17-21	<b>WINTER READING WEEK</b>	
Feb 24-28	Life annuities, pure endowments (section 10.1, 10.2, 10.3)	
<b>In-class Quiz #6 – Wed, February 26 at start of class</b>		
Mar 3-7	Whole life, temporary and deferred life annuities, (section 10.4-10.6)	
Mar 10-14	Varying annuities, life annuities payable more than once a year, whole life insurance (section 10.7, 10.8, 11.1)	
<b>In-class Quiz #7 – Wed, March 12 at start of class</b>		
Mar 17-21	Whole life insurance (section 11.2, 11.3), Net Annual Premiums (11.4)	
Mar 24-28	Term, endowment, deferred, varying insurance (sect 11.5 to 11.8)	
<b>In-class Quiz #8 – Wed, March 26 at start of class</b>		
Mar 31, Apr 2-4	Expenses; Types of life insurance expenses (section 12.1, 12.2)	
<b>Final Exam – To be scheduled in final exam period</b>		

## 12. General information about missed coursework

If a student misses a major exam (midterm 1, midterm 2 or final exam), they need to provide documentation as to why they missed the exam and submit it to academic counselling in their faculty for approval. The Student Medical Certificate is available at

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf)

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.

**This year students are allowed to submit what is referred to as an SRA** (self-reporting absence), which allows the student to miss one piece of coursework per semester (but not for the final exam) for any reason, without having to submit any documentation.

However, course instructors are allowed to designate one exam per semester where a student cannot use an SRA. To this end, it has been decided to allow students to use an SRA for one of the two midterms in this course, but not for both. **Keep in mind that it is NOT a requirement for students to use any SRA's. It is advisable for students to write the exams on the date and time they are scheduled unless you really are sick and unable to write.**

With this in mind, here is information about what to do if you miss any of the required work in this course:

### a) Final Exam

- Students cannot use an SRA
- If the exam is missed for a valid reason, the student must provide documentation to academic counselling in their faculty.
- If approved, the student will write the make up exam (which is usually held during the second Thursday in May)

### b) Midterm 1

- Students may use an SRA
- OR they can provide documentation to academic counselling
- Those using an SRA, or those with academic counselling approval, will write the make up exam, normally held on the Thursday following the date of the exam (the weight of midterm 1 will NOT be transferred to other parts of the grading scheme)

### c) Midterm 2

- Students may use an SRA, but **ONLY** if they have not used an SRA for midterm 1
- Otherwise they must provide documentation to academic counselling
- Those using an SRA, or those with academic counselling approval, will write the make up exam, normally held on the Thursday following the date of the exam (the weight of midterm 2 will NOT be transferred to other parts of the grading scheme)

d) In-class Quizzes

- Since the quizzes are set up so that only the best 6 of 8 count towards your final mark, using an SRA for any missed quizzes will not be allowed, nor will any medical reason be allowed for missing a third quiz
- If more than two quizzes are missed, they will count as a mark of ZERO (and count as one of the “best 6 out of 8” quizzes)

Students must familiarize themselves with the *University Policy on Academic Consideration – Undergraduate Students in First Entry Programs* posted on the Academic Calendar:  
[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/academic\\_consideration\\_Sep24.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf).

This policy does not apply to requests for Academic Consideration submitted for **attempted or completed work**, whether online or in person. That is, the above information is only good for course work that was MISSED.

For procedures on how to submit Academic Consideration requests, please see the information posted on the Office of the Registrar’s webpage:

[https://registrar.uwo.ca/academics/academic\\_considerations/](https://registrar.uwo.ca/academics/academic_considerations/)

All requests for Academic Consideration must be made within 48 hours after the assessment date or submission deadline.

When a student mistakenly submits their one allowed Academic Consideration request **without supporting documentation (an SRA)** for the assessments listed above, the request cannot be recalled and reapplied. This privilege is forfeited.

### 13. Additional Statements

#### Religious Accommodation

When conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request an accommodation for their absence in writing to the course instructor and/or the Academic Advising office of their Faculty of Registration. This notice should be made as early as possible but not later than two weeks prior to the writing or the examination (or one week prior to the writing of the test).

Please visit the Diversity Calendars posted on our university's EDID website for the recognized religious holidays:

<https://www.edi.uwo.ca>.

#### Accommodation Policies

Students with disabilities are encouraged to contact Accessible Education, 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).

#### Academic Policies

The website for Registrar Services is <https://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 their 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:

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf).

#### Support Services

Please visit the Science & Basic Medical Sciences Academic Advising 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/>.

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

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have

experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at

[https://www.uwo.ca/health/student\\_support/survivor\\_support/get-help.html](https://www.uwo.ca/health/student_support/survivor_support/get-help.html).

To connect with a case manager or set up an appointment, please contact [support@uwo.ca](mailto:support@uwo.ca).

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

[http://academicsupport.uwo.ca/accessible\\_education/index.html](http://academicsupport.uwo.ca/accessible_education/index.html)

if you have any questions regarding accommodations.

Learning-skills counsellors at Learning Development and Success (<https://learning.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.

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

### **Absences from Final 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).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under Special Examinations).