

The University of Western Ontario  
 Department of Statistical and Actuarial Sciences  
**ACTUARIAL SCIENCE 2053 – Section 650 (Online) – Spring/Summer 2020**  
*Mathematics for Financial Analysis*

**Instructor:** Joseph Raaymakers, M.Sc.  
**Contact:** [jraaymak@uwo.ca](mailto:jraaymak@uwo.ca) or via forums in OWL  
**Office Hours:** Online via Zoom (by appointment)  
**Lectures:** Posted Monday, Wednesday and Friday afternoons  
**Tutorials:** Online via Zoom on Fridays, 1:30 – 2:30 pm

**Prerequisite(s)**

Mathematics 0110A/B or Grade 12U Advanced Functions and Introductory Calculus (MCB 4U) or equivalent, PLUS 1.0 course or two 0.5 courses at the 1000 level or higher from Applied Mathematics, Calculus or Mathematics

**Anti-requisite(s)**

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.**

**Textbooks (e-copies of both are available from the UWO bookstore)**

- “Mathematics of Finance”, 8th Edition, by Brown-Kopp
- Study note package

**Course Outline Summary:**

The first 7- 8 weeks will cover topics from the Mathematics of Finance text and the last 4-5 weeks will cover topics from the study note package as follows:

Text	Chapter	Topic (week)
<b>1. Mathematics of Finance</b>	1	Simple Interest (week 1)
	2	Compound Interest (week 2)
	3	Simple Annuities (week 3&4)
	4	General Annuities (week 5)
	5	Repaying A Debt (week 6)
	6	Bonds (week 7)
	7	Business Decisions, Capital Budgeting, Depreciation (week 8)
<b>2. Study Note Package</b>	8	Fixed Income Investments (week 8)
	9	Probability and Life Tables (week 9)
	10	Life Annuities (week 10)
	11	Life Insurance (week 11&12)
	12	Life Insurance Expenses (week 12)

**Course Schedule - Topics and Assessments**

A detailed weekly timetable is included on the last page of this syllabus.

## **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, either using a calculator, pen and paper OR using a computer spreadsheet. 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. Depreciating physical assets
5. Determining the rate of return on an investment
6. Determining the price of a bond or the rate of return on a bond
7. 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 assignments and likely through a combination of multiple choice/written answer questions on three tests and a final exam.

## **Calculator requirements**

You will need a pocket (non-programmable) calculator for all assessments. Any such calculator is fine, including financial calculators.

## **Evaluation**

**Your final course grade will be determined as follows;**

	<b>Original</b>
Assignments (4 x 3.75%)	15%
Test 1	15%
Test2	15%
Test 3	15%
Final Exam	40%

There will be no make-up tests or assignments for students that miss these assessments for a valid reason (accommodation approved by their faculty or a recorded self reported absence). For details on how to request academic consideration, please see the Academic Consideration section included in a later section of this course outline. For students that miss either a test or assignment for a valid reason, the weight of the missed assessment will be reassigned to remaining test and final exam components.

## Course Assessments

### a) Three Term Tests

Test 1: Monday, May 25, 2020 – a 2 hour test with topics to be posted on OWL

Test 2: Monday June 22, 2020 – a 2 hour test with topics to be posted on OWL

Test 3: Monday July 13, 2020 – a 2 hour test with topics to be posted on OWL

These tests will be non-cumulative (e.g. chapters tested on test1 will not be tested on Test2) and the format will most likely be all multiple-choice. A formula page will be provided for each test.

**NOTE:** There is **NO** makeup test for any missed tests. If you miss a test (with a valid reason), the weight will be reassigned to the other test and exam components.

### b) Final Exam

**To be scheduled by the Registrar during the distance studies final exam period (Aug. 4 -7<sup>th</sup>)**

The final exam will be an online 3-hour exam that may either be multiple-choice questions OR a combination of multiple choice and short written answer questions. The final exam will be a cumulative exam (Ch.3 -12) with a heavy focus on material covered in Chapters 9 -12. A formula page will be provided.

### c) Assignments

There will be 4 written answer assignments. They will consist of questions from the previous week(s) course material. The assignment due dates (times are given as eastern daylight time) are indicated below:

Assignment 1 due: Friday May 15 <sup>th</sup> , 2020 (4:00 pm)
Assignment 2 due: Friday June 12 <sup>th</sup> 2020 (4:00 pm)
Assignment 3 due: Friday July 3 <sup>rd</sup> , 2020 (4:00 pm)
Assignment 4 due: Friday, July 24 <sup>th</sup> , 2020 (4:00 pm)

Assignments will be posted on OWL about a week before the respective due date. You answers can either be neatly written by hand (or typed if you wish). **You must create a single pdf file submission of your completed assignment to upload.** You will be sent out information on how to upload your assignment solutions with the first assignment.

I have tried to space out the dates that things are due in this course so that you have time to get things done and not feel overwhelmed. ***Please note that no late assignments will be accepted.***

## Course OWL Web Page

Students should check OWL (<http://owl.uwo.ca/portal>) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class. Students are responsible for checking OWL on a regular basis. The web page will contain:

1. A copy of this course outline
2. Updates and information about the course that you need to know
3. Extra readings (for some topics) that will supplement your class notes
4. Daily lecture notes and other things that are relevant to the course
5. Sample/past exams/tests and solutions
6. Marks of assignments and tests as they are marked

### **Intellectual Property Statement**

Course material (i.e. course content (including lecture notes), videos, solutions, practice questions and other supplementary material posted on OWL) is the intellectual property of your instructors and course developers and is made available to you for your personal use in this course. *Sharing, posting, selling or using this material outside your personal use in this course is considered to be an infringement of intellectual property rights.*

### **Policy on tests and examinations**

Tests and examinations in this course may be conducted using the remote proctoring service Proctortrack. Therefore, completion of this course will require you to have a device that meets the requirements at

<https://www.proctortrack.com/tech-requirements/>.

By taking this course, you are consenting to the use of this software and to be monitored during tests and examinations. Furthermore, you are declaring that you have a reliable internet connection with sufficient capacity to support video proctoring.

### **Policy on e-mail communication**

You are welcome to communicate with your instructor by e-mail, but e-mail communication should only be used to provide them with information or to ask a question that requires a brief response. For more lengthy discussions and for discussions on lectures/course material please see your instructor during their scheduled office hours or by appointment. If you do e-mail them, please use your UWO account, as these are often the only emails read (as e-mails sent from other addresses often get spammed).

### **Attendance**

The Department of Statistical and Actuarial Sciences views classroom attendance as a very important part of the learning process. Regular engagement with the online course materials and in online tutorials is strongly encouraged. Students are advised that excessive absenteeism may result in being debarred from the final examination (see Western Academic Calendar).

### **Classroom Environment**

The Department of Statistical and Actuarial Sciences has adopted a “Mutual Expectations” policy governing the classroom environment and all work submitted by students. [The full text of the policy can be found at <https://www.uwo.ca/stats/undergraduate/mutual-expectations.html>]. Although these were developed with a lecture-based course in mind, the spirit of the expectations applies to this course as well. In summary the policies developed are under the premise that all interactions between student and faculty should be governed by the principles of courtesy, respect and honesty.

Students are encouraged to ask questions on the appropriate forums. Do not use course-related OWL Forums for social conversation unrelated to the course. Keep postings to the OWL Forums positive and productive – the OWL Forums are an important component of our learning environment. Inappropriate or disrespectful postings will not be tolerated.

## **Department Policy on Missed Course Requirements and Student Health and Wellness**

If you are unable to meet a course requirement due to illness or other serious circumstances, you must seek approval for the absence as soon as possible. During the COVID-19 pandemic, medical notes are not required. Medical absence can be reported through the Student Illness Reporting Tool at

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

If this portal is not available (i.e., if the COVID-19 pandemic has lifted before the end of the course), or if you have missed (or will be missing coursework) for a non-medical reason beyond your control, approval can be granted either through a Self-reported Absence (if the portal is available) or via the Dean's Office/Academic Counselling unit of your Home Faculty. Non-medical reasons must be accompanied by supporting documentation. If you are a Science student, contact information for the Academic Counselling Office for the Faculty of Science is available at

<https://www.uwo.ca/sci/counselling/>.

In all cases, you must contact your instructor as soon as possible, and no later than 24 hours after the period covered, to clarify how you will be expected to fulfil the academic expectations you have missed (unless other instructions are indicated in this Course Outline). For further information, please consult the University's policy on academic consideration for student absences:

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/Academic\\_Consideration\\_for\\_absences.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Consideration_for_absences.pdf)

**For Final Exam:** If you miss the Final Exam, please contact your faculty's Academic Counselling Office as soon as you are able to do so. They will assess your eligibility to write the Special Exam (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" (see [http://www.registrar.uwo.ca/examinations/exam\\_schedule.html](http://www.registrar.uwo.ca/examinations/exam_schedule.html)).

**For Midterm Exam:** The policy of the Department of Statistical and Actuarial Sciences is that there will be no make-up exams for a midterm missed due to illness. If your accommodation is approved, the weight of the missed midterm will be reassigned to the final exam. If your accommodation is not approved, then you will receive a mark of 0 for your midterm.

If you have any conflict that prevents you from writing a midterm, you must check with your instructor as soon as possible (and prior to the exam) so that alternate arrangements can be made.

### **Academic Policy**

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

In accordance with policy, <http://www.uwo.ca/its/identity/activatenonstudent.html>, 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 this website:

[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.

### **Support Services**

Learning-skills counsellors at the Student Development Centre 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: <http://sdc.uwo.ca/>.

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

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

### **Accessibility**

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 Services for Students with Disabilities (SSD) at 661-2111 ext. 82147 if you have questions regarding accommodation.

The policy on Accommodation for Students with Disabilities can be found here:

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/Academic%20Accommodation\\_disabilities.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic%20Accommodation_disabilities.pdf)

The policy on Accommodation for Religious Holidays can be found here:

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

**Weekly Course Schedule - includes Topics and Assessments**

<b>Week #</b>	<b>Dates</b>	<b>Topics and Chapter Reference</b>
1	May 4 - 10 <sup>th</sup>	<b><u>Chapter 1 Simple Interest and Simple Discount</u></b> 1.1 Accumulated Value at Simple Interest    1.2 Discounted Value at Simple Interest 1.3 Equations of Value    1.4 Partial Payments 1.5 Simple Discount at a Discount Rate
2	May 11 - 17 <sup>th</sup>  <b>AST 1 May 15</b>	<b><u>Chapter 2 Compound Interest</u></b> 2.1 Compound Interest Formula    2.2 Equivalent Compounded Interest Rates 2.3 Discounted Value    2.4 Fractional Periods of time (AV and PV) 2.5 Determining the rate and the time    2.6 Equations of Value 2.7 Varying Compound Interest Rates    2.8 Inflation and “real” rate of interest 2.9 Other Compound Applications <del>2.10 (Continuous Compounding)</del> -OMIT
3	May 18 - 24 <sup>th</sup>	<b><u>Chapter 3 Simple Annuities</u></b> 3.1 Definitions    3.2 Accumulated Value (Ordinary Simple annuity) 3.3 Discounted Value (Ordinary Simple Annuity) <i>Test1 Review</i>
4	<b>Test1 May 25</b> May 25 - 31 <sup>st</sup>	<b><u>Chapter 3 Simple Annuities (continued)</u></b> 3.4 Other Simple Annuities    3.5 Determining Annuity Term 3.6 Determining Annuity Interest Rate
	June 1 - 7 <sup>th</sup>	No undergraduate course activities
5	June 8 - 14 <sup>th</sup>  <b>AST2 June 12</b>	<b><u>Chapter 4 General &amp; Other Annuities</u></b> 4.1 General Annuities    4.2 Mortgages in Canada 4.3 Perpetuities    4.4 Annuities with varying payments
6	June 15 - 21 <sup>st</sup>	<b><u>Chapter 5 Repayment of Debts</u></b> 5.1/2 Amortization of Debt/Loan Balance    5.3 Refinancing-Amortization Method 5.4 Refinancing-Sum of Digits Method    5.5/6/7 Sinking Fund Method Topics <i>Test2 Review</i>
7	<b>Test2 June 22</b> June 22 - 28 <sup>th</sup>	<b><u>Chapter 6 Bonds</u></b> 6.1/2 Intro. & Terminology, Bond Price    6.3 Premium & Discount 6.4 Callable Bonds    6.5 Bond Price between Interest Dates 6.6 Determining the Yield Rate    6.7 Other Types of Bonds
8	June 29 -July 5 <sup>th</sup>  <b>AST3 July 3</b>	<b><u>Chapter 7 Business Decisions, Capital Budgeting &amp; Depreciation</u></b> 7.1 Net Present Value (NPV)    7.2 Internal Rate of Return (IRR) 7.3 Capitalized Cost    7.4 Depreciation <b><u>Chapter 8 Fixed Income Securities</u></b> 8.1 Fixed Income investments    8.2 Yield curve, forward Interest rates 8.3 Types or Risks    8.4 - 8.7 Duration, convexity
9	July 6 - 12 <sup>th</sup>	<b><u>Chapter 9: The Life Table</u></b> 9.1- 9.5 Probability, Survival Probability, Life Table structure & applications 9.6 Expectation of life    9.7 Select tables & survival probabilities <i>Test3 Review</i>
10	<b>Test3 July 13</b> July 13- 19 <sup>th</sup>	<b><u>Chapter 10: Life Annuities</u></b> 10.1 Intro, terminology, notation    10.2/3 NSP/APV, Pure Endowments 10.4 Whole Life Annuities    10.5 Temporary Life Annuities
11	July 20 - 26 <sup>th</sup>  <b>AST4 July 24</b>	<b><u>Chapter 10: Life Annuities continued</u></b> 10.6 Deferred Life Annuities    10.7 Varying Life Annuities 10.8 Life annuities with “mthly” payments <b><u>Chapter 11: Life Insurance</u></b> 11.1 - 11.4 Introduction and Whole life Insurance Topics including Net Single Premium & Net Annual Premium calculations & relationship with life annuity due
12	July 27 - July 31	<b><u>Chapter 11: Life Insurance continued</u></b> 11.5 Term Insurance    11.6 Endowment Insurance 11.7 Deferred Insurances    11.8 Varying Insurances <b><u>Chapter 12- Expenses and Gross Premium Calculations</u></b> 12.1 - 12.3 Expense types and Gross Premium Calculations
	August 1- 7	<i>Exam Review</i> <b>Online Final Exam August 4 - 7 (date scheduled by registrar)</b>