

**MA373A – Introduction to Actuarial Mathematics, Winter 2021**  
**Department of Mathematics, Faculty of Science, Wilfrid Laurier University**

**Instructor**

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**Course Information**

- Calendar description: Survival distributions, life tables, life annuities, and life insurance. Calculation of premiums and reserves. Introduction to policy valuation.
- Pre-requisites: MA103 (or MA110), MA170, ST259 (or MA240) or a similar course in probability and statistics such as EC255 and EC285.

**Goals**

The goal for this course is to learn and understand valuation of non-deterministic cash flows, mainly cash flows contingent on person's life. We will study survival distributions, life tables, life annuities, and life insurance. Will also learn how to calculate premiums and reserves. Such concepts form the basis for the life insurance practice.

**Learning Outcomes**

This course provides a thorough introduction to the evaluation of life contingencies. By the end of this course, successful students will be able to:

- Describe survival models for human lives and resulting cash flows that start or stop contingent upon survival
- Calculate future lifetime probabilities using various survival models;
- Calculate the complete and curtate expected lifetime of an individual;
- Apply the illustrative life table survival model;
- Evaluate the cost of various life insurance cash flows;
- Evaluate the cost of various life annuity cash flows;
- Determine charged premiums for insurance;
- Calculate the benefit reserve for an insurer at a future date.

**Resources:**

- **Text:** *Actuarial Mathematics for Life Contingent Risks*, 3rd Edition. David C. M. Dickson, Mary R. Hardy, Howard R. Waters, January 2020. ISBN: 9781108478083.
- **YouTube Channel:** all pre-recorded sessions I created will be posted at: [Introduction to Actuarial Mathematics - YouTube](#)
- Problem sets will be posted weekly on MylearningSpace.
- Additional resources can be found on the Society of Actuaries website (click on this link [Exam LTAM: Long-Term Actuarial Mathematics | SOA](#)). Specifically, you need to download the lifetables that we will use extensively in this course ([Exam LTAM Tables \(soa.org\)](#)).

### **Expectations:**

You are expected to do most of your learning independently. Actuarial Mathematics, like most subjects, is learned by doing it. Pre-recorded sessions will provide you with comprehensive resources to help you understand the concepts and how they are applied. In addition, the office hours are a time where you can reach out for more help. But there will not be time in both recorded sessions and during office hours to do a lot of exercises. To help you practice, I will post weekly problems sets as homework problems. A few of the homework problems may be worked in pre-recorded sessions and/or office hours as examples. If possible, you are encouraged to use available technology to collaborate with other students on the homework. Homework will not be graded but prepare you for other graded work.

### **Technology Requirements:**

To participate in this course, you are required to have the following electronic equipment/software:

- A Windows PC or MAC with a built-in webcam or external webcam.
- A microphone, either external, as a part of the stand-alone webcam, or built into the computer.
- An internet-connected cellphone or tablet (or, alternatively, a scanner or digital camera).
- You need to scan or take pictures of your written solutions of the midterm-tests and final exam in order to submit them. Microsoft's Office Lens, Genius Scan and CamScanner are free mobile app for iOS or Android devices that allow you to transfer pictures of documents to a PDF file. **The images must be converted into a single PDF file, with all pages upright and in portrait mode, and clearly legible.**
- In this class, we will use Zoom. Please be sure to register your [Zoom account](#) using your @mylaurier.ca email account before the first zoom meeting. You may also want to download and install the Zoom application. General information about Zoom can be found on the Laurier website.
- You will be required to use [Respondus LockDown Browser and Monitor](#) to be able to take midterms and final examinations, since they will be written online.

### **Lectures and Office Hours**

This course will use a blended approach of asynchronous and synchronous as follows:

- **Pre-recorded sessions** will be posted weekly in line with the syllabus coverage (see syllabus). I tried my best to make these videos high resolutions so you can read easily from your screen (hope you have access to a good size screen as it is still difficult to read from your phone). The price for the high-resolution videos is the very large size of these files, but no need for you to download them (they will take about 29.4 GB!). For your convenience, all pre-recorded sessions will be posted in the [class YouTube channel](#) I created and they will remain posted for the whole term.
- For the office hours, we will use synchronous (live) learning sessions every **Wednesday at 5:30 pm- 6:30 pm**. I already scheduled all office hours through Zoom and they should appear in your MLS. Office hours are optional to attend.

They are intended to serve as a designated time for you to ask questions related to the material covered, concepts, assignment, exams etc. To ensure that you are comfortable to ask questions, the office hours sessions **will not** be recorded.

- For personal issues (not related to material coverage), you may use the email. You may also request a virtual meeting to discuss in person.

### **Graded Work:**

There will be two midterms and a final examination, each is two-hours long. As topics are built on each other (e.g. you need to know topics covered in exam 1 to do problems in later exams), all exams are cumulative. Below is exam information:

#### **1- Midterm 1(30 %):**

- The first midterm exam is tentatively scheduled for Feb 22nd, 2021 from 3:00 pm – 5:00 pm.
- Coverage: textbook (chapter 1, 2, 3, and appendix A). Recorded videos (all videos from 1.1 to 5.6 (inclusive)). All corresponding weekly assignments.

#### **2- Midterm 2 (30 %):**

- The second midterm exam is tentatively scheduled for March 24th, 2021 from 5:30 pm – 7:30 pm.
- Coverage: textbook (chapter 1, 2, 3, 4, and 5). Recorded videos (all videos from 1 to 7.5 (inclusive)). All corresponding weekly assignments.

#### **3- Final Exam (40 %):**

- The final exam will be between April 15<sup>th</sup> and 30<sup>th</sup>, 2021, the exact date will be determined by the registrar.
- Coverage: textbook (chapter 1, 2, 3, 4, 5, 6, and 7 (selected topics). Recorded videos (all videos from 1. to 9.2 (inclusive)). All weekly assignments.

**Calculator Policy:** You may use a non-programmable, non-graphing calculator on course tests and the final examination. **Please make sure to have your calculator ready for the exams.**

Any **error in marking** must be reported to me within *one week* of the date the grade was released. No marks will be changed after that time. Please see the model solutions posted on MLS before bringing any alleged errors to the attention of your instructor. *The instructor reserves the right to re-mark the entire paper.*

**Syllabus:** Anticipated coverage of the text, subject to change, is as follows:

<b>Week</b>	<b>Dates</b>	<b>Topic</b>	<b>Text coverage</b>	<b>Pre-recorded Videos</b>
1	Jan 11 -13	Introduction  Review: Probability Theory	Chapter 1 (read lightly only sections 1.1 – 1.6) Appendix A	1. Introduction  2.1-2.4 (Probability theory review A, B, C, D)
2	Jan 18 - 20	Review: Interest Theory  Continuous Survival Models	Chapter 2	3.1-3.4 (Interest theory review A, B, C, D)  4.1-4.2 Continuous Survival model A and B)
3	Jan 25 – 27	Continuous Survival Models	Chapter 2	4.3-4.6 (Continuous Survival model (C, D, E, F)
4	Feb 1 - 3	Life Tables Approach	Chapter 3	5.1-5.3: Life Tables Approach (A, B, C)
5	Feb 8 - 10	Life Table Approach	Chapter 3	5.4-5.6 (Life Tables Approach D, E, F)
	Feb 15 - 17	No classes, reading week		
<b>Mid-term 1: Monday Feb 22nd from 3:00 pm – 5:00 pm</b>				
6	Feb 22 - 24	Insurance Benefits	Chapter 4	6.1-6.2 (Insurance Benefits A, B)
7	March 1 - 3	Insurance Benefits	Chapter 4	6.3-6.5 (Insurance Benefits C, D, E)
8	March 8 - 10	Insurance Benefits  Life Annuities	Chapter 4  Chapter 5	6.6-6.7 (Insurance Benefits F, G)  7.1 -7.2 (Life Annuities A, B)
9	March 15 - 17	Life Annuities	Chapter 5	7.3 -7.5 (Life Annuities C, D, E)
<b>Mid-term 2: Wednesday March 24th from 5:30 pm – 7:30 pm</b>				
10	March 22 - 24	Premiums	Chapter 6	8.1- 8.2 (Premiums A, B)
11	March 29 - 31	Premiums	Chapter 6	8.3- 8.6 (Premiums C, D, E, F)
12	April 5- 7	Introduction to Benefit Reserves	Chapter 7	9.1-9.2 (Benefit Reserve A, B)
	April 15-30	Final Exam Period		

## Notes

Students are expected to be aware of and abide by all University regulations and policies, as outlined in the current [Academic Calendar](#). In particular,

### **1. Final Examinations**

Students must reserve the examination period of **April 15-30, 2021**. If you are considering registering for a special examination or event, you should select a time outside the examination period. Consult Academic Regulations in the Academic Calendar for special circumstances for examination deferment.

### **2. Special Needs**

Students with disabilities or special needs are advised to contact Laurier's Accessible Learning Centre for information regarding its services and resources. Students are encouraged to review the [Academic Calendar](#) for information regarding all services available on campus.

### **3. Academic Integrity/Misconduct (cheating, plagiarism)**

The University has a defined policy with respect to academic misconduct; penalties are severe and enforced at all times. You are responsible for familiarizing yourself with this policy and accompanying penalty guidelines, and are cautioned that, in addition to failure in a course, students may be suspended or expelled from the University for academic misconduct, and the offence may appear on their transcripts. The relevant policy can be found at Laurier's [academic integrity](#) website along with resources to educate and support you in upholding a culture of integrity. Ignorance of Laurier's academic misconduct policy is not a defence.

Academic misconduct includes, but is not limited to, transmission or reception of information, or possession of unauthorized information, during laboratories, quizzes, tests, or examinations. Academic misconduct also includes plagiarism. Wilfrid Laurier University uses software that can check for plagiarism. If requested to do so by the instructor, students are required to submit their written work in electronic form and have it checked for plagiarism. [WLU Policy 12.2 Student Code of Conduct and Discipline](#) provides information on academic and research misconduct code, and the procedures for investigating and determining appropriate disciplinary measures for breaches of this Code.

### **4. Intellectual Property**

The educational materials developed for this course, including, but not limited to, lecture notes and slides, handout materials, examinations and assignments, and any materials posted to MyLearningSpace, are the intellectual property of the course instructor. These materials have been developed for student use only and they are not intended for wider dissemination and/or communication outside of a given course. Posting or providing unauthorized audio, video, or textual material of lecture content to third-party websites violates an instructor's intellectual property rights, and the Canadian Copyright Act. Recording lectures in any way is prohibited in this course unless specific permission has been granted by the instructor. Failure to follow these instructions may be in contravention of the university's Student Non-Academic Code of Conduct and/or Code of Academic Conduct, and will result in appropriate penalties. Participation in this course constitutes an agreement by all parties to abide by the relevant University Policies, and to respect the intellectual property of others during and after their association with Wilfrid Laurier University.

## 5. Use of Zoom for Instructional Purposes

Wilfrid Laurier University uses a range of technologies to facilitate in-person and remote instruction. Zoom is currently used for remote course delivery, including lectures, seminars, and group office hours, which may be recorded, stored and shared through MyLearningSpace for access by students in the course. For these course activities, students are permitted to turn off their cameras or use an alternative name to maintain their privacy after they have confirmed this with their instructor. Student personal information is collected and used in the course in accordance with University policies and the Notice of Collection, Use or Disclosure of Personal Information. All exams and mid-terms in the course that are conducted online will be proctored using only technologies approved for assessment at Laurier as outlined on this page.

## 6. Recording Synchronous Classes

Synchronous (live) class sessions will be delivered in this course through a video conferencing platform supported by the university [Zoom, Teams, Virtual Classroom]. Steps have been taken to protect the security of the information shared. For more information about Zoom and Office365 (including Teams), please visit ICT's Tech Support and Services page. Class sessions will be recorded with the video and audio (and in some cases transcription) made available to students in the course in MyLearningSpace for the duration of the term. The recordings may capture your name, image or voice through the video and audio recordings. By attending in these live classes, you are consenting to the collection of this information for the purposes of administering the class and associated course work. If you are concerned about the use or collection of your name and other personal information in the class, please contact the course instructor to identify possible alternatives. To learn more about how your personal information is collected, used and disclosed by the University, please see Laurier's Notice of Collection, Use and Disclosure of Personal Information.

## 7. Classroom Use of Electronic Devices

The use of electronic devices in the classroom is governed by WLU [Policy 9.3: Classroom Use of Electronic Devices](#). Details of this Policy and the consequences of breaches are stated in the Academic Calendar.

- Students are expected to keep their microphones muted unless called to participate.
- Students may, if they wish, turn off their video, so that they are not on display to other class members. If students decide to show their video, then they are expected to behave in a professional manner.

## 8. Multi-campus Resource

- [Good2Talk](#) is a postsecondary school helpline that provides free, professional and confidential counselling support for students in Ontario. Call 1-866-925-5454. Available 24-7.

### Kitchener/Waterloo Resources

- [Waterloo Student Food Bank](#): All students are eligible to use this service to ensure they're eating healthy when overwhelmed, stressed or financially strained. Anonymously request a package online 24-7. All dietary restrictions accommodated.
- [Waterloo Student Wellness Centre](#): 519-884-0710 x3146, [wellness@wlu.ca](mailto:wellness@wlu.ca) or @LaurierWellness. The Centre supports the physical, emotional, and mental health needs of students. It is located on the 2<sup>nd</sup> floor of the Student Services Building.  
Current hours: Monday, Tuesday, Wednesday: 9 a.m. to 7:30 p.m.; Thursday and Friday: 9 a.m. to 4:15 p.m.

Appointments continue to be remote at this time. Please call us for service. Do not drop by the centre unless instructed by a nurse.

[Visit our Urgent and After-Hours Care](#) resource page for information on where to get care when we are closed.

Visit our [Mental Health Resources](#) page under 'Remote Resources' for more support during this disruption to in-person service.

The Student Wellness Centre is closed when the university is closed. If you miss a scheduled appointment due to an unexpected university closure, please call us the next day to rebook your appointment.

### **Course Drop Dates Winter 2021**

**January 15:** Last day to drop/withdraw from 12-week course(s) at no tuition charge (provided the student remains registered in at least one course).

**January 22:** Last day to drop/withdraw from 12-week course(s) at 10% tuition charge (assessed at course rate).

**March 12:** Last day to drop full-year or 12-week winter course(s) or withdraw without failure and for possible tuition adjustment (tuition charge assessed at 55% of the course rate).