ACTS 4308 - Actuarial Financial Mathematics

Spring 2026

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Class Time	Tue & Thu, 10:00 AM - 11:15 AM
Classroom	SCI 2.225
Office Hours	Tue 8:30 AM - 9:30 AM
Office	FO 2.410G

Brief Description

The purpose of this 3 semester credit hour course is to provide an understanding of the fundamental concepts of financial mathematics, and how those concepts are applied in calculating present and accumulated values for various streams of cash flows as a basis for future use in: reserving, valuation, pricing, asset liability management, investment income, capital budgeting, and valuing contingent cash flows. The topics discussed include loans, bonds, and annuities. This class covers parts of the CAS Exam 2 and the SOA Exam FM.

Prerequisite: MATH 3351 with a grade of C- or higher.

Required Background

This course assumes a basic knowledge of calculus and an introductory knowledge of finance.

Calculators (required): In order to simulate actuarial exam conditions, the following SOA approved exam calculators are required:

1. TI-30X MultiView (XS Solar or XB Battery)
2. BA II Plus/ BA II Plus Professional

For additional information, please see SOA Approved Calculators.

Recommended Textbook and Online Resources (Not Required)

- The Infinite Actuary (TIA), *Exam FM Online Seminar* - **FREE**
- Coaching Actuaries, *Exam FM Online Seminar*
- Dinius et al., *ACTEX Study Manual for SOA Exam FM*

Tentative Course Outline:

- Interest Rates and Time Value of Money
- Annuities
- Loan Amortization
- Bonds
- Yield Rate of an Investment
- Asset Liability Management

Course Description and Objectives

At the end of the course, students will have knowledge in the following areas:

A. Time Value of Money

The student will be able to

1. Define and recognize the definitions of the following terms: interest rate (rate of interest), simple interest, compound interest, accumulation function, future value, current value, present value, net present value, discount factor, discount rate (rate of discount), convertible m-thly, nominal rate, effective rate, inflation and real rate of interest, force of interest, equation of value.
2. Given any three of interest rate, period of time, present value, current value, and future value, calculate the remaining item using simple or compound interest. Solve time value of money equations involving variable force of interest.
3. Given any one of the effective interest rate, the nominal interest rate convertible m-thly, the effective discount rate, the nominal discount rate convertible m-thly, or the force of interest, calculate any of the other items.
4. Write the equation of value given a set of cash flows and an interest rate.

B. Annuities/cash flows with payments that are not contingent

1. The student will be able to define and recognize the definitions of the following terms: annuity-immediate, annuity due, perpetuity, payable m-thly or payable continuously, level payment annuity, arithmetic increasing/decreasing annuity, geometric increasing/decreasing annuity, term of annuity.
2. For each of the following types of annuity/cash flows, given sufficient information of immediate or due, present value, future value, current value, interest rate, payment amount, and term of annuity, the student will be able to calculate any remaining item.
   (a) Level annuity, finite term
   (b) Level perpetuity
   (c) Non-level annuities/cash flows

C. Loans

The student will be able to:

1. Define and recognize the definitions of the following terms: principal, interest, term of loan, outstanding balance, final payment (drop payment, balloon payment), amortization.
2. Given any four of term of loan, interest rate, payment amount, payment period, principal, calculate the remaining item.
3. Calculate the outstanding balance at any point in time.
4. Calculate the amount of interest and principal repayment in a given payment.
5. Given the quantities, except one, in a sinking fund arrangement calculate the missing quantity.
6. Perform similar calculations to the above when refinancing is involved.

D. Bonds

1. The student will be able to define and recognize the definitions of the following terms: price, book value, amortization of premium, accumulation of discount, redemption value, par value/face value, yield rate, coupon, coupon rate, term of bond, callable/non-callable.
2. Given sufficient partial information about the items listed below, the student will be able to calculate the any of the remaining items.

(a) Price, book value, amortization of premium, accumulation of discount
(b) Redemption value, face value
(c) Yield rate
(d) Coupon, Coupon rate
(e) Term of bond, point in time that a bond has a given book value, amortization of premium, or accumulation of discount

3. Calculate the price of a callable bond to achieve a specified minimum yield

E. General Cash Flows and Portfolios

The student will be able to:

1. Define and recognize the definitions of the following terms: yield rate/rate of return, current value, duration and convexity (Macaulay and modified), portfolio, spot rate, forward rate, yield curve, cash flow and duration matching, and immunization (including full immunization and Redington immunization).
2. Calculate:
   (a) The duration and convexity of a set of cash flows.
   (b) Either Macaulay or modified duration given the other.
   (c) The approximate change in present value due to a change in interest rate,
      – Using 1st-order linear approximation based on modified duration.
      – Using 1st-order approximation based on Macaulay duration.
   (d) The present value of a set of cash flows, using a yield curve developed from forward and spot rates.
3. Construct an investment portfolio to:
   (a) Protect the value of an asset-liability portfolio using either Redington or full immunization
   (b) Exactly match a set of liability cash flows.

Important Dates:

- Classes begin ..... Tue, Jan 20
- Last Day to Drop a Class without a "W" ..... Wed, Feb 4
- **Midterm Exam #1** ..... Tue, Mar 3, 10:00 AM - 11:15 AM **in Classroom**
- Mid-Term grades viewable online ..... Sat, Mar 14
- **Midterm Exam #2** ..... Thu, Apr 16, 10:00 AM - 11:15 AM **in Classroom**
- Spring break, No classes ..... Mon, Mar 16 – Sun, Mar 22
- Last day of classes for full term session ..... Fri, May 8
- **Final Exam** ..... **TBA**

Grading Scheme

- – Participation: 5%
  – Weekly or biweekly assignments: 15%
  – Two midterm exams: 25% each
  – Final exam (Comprehensive): 30%
- All letter grades will be assigned in accordance with the table of numeric to alphabetic conversions given below.

A+	98 – 100	A	94 – 97	A–	90 – 93
B+	85 – 89	B	80 – 84	B–	75 – 79
C+	70 – 74	C	65 – 69	C–	60 – 64
D+	55 – 59	D	50 – 54	D–	45 – 49
F	0 – 44				

Homework submission

- Scan your assignment as a **single pdf** and upload it on eLearning. DO NOT submit multiple files.
- You will have **unlimited submission attempts** to upload homework assignment, in case something goes wrong. Only the final submission will be graded.
- If you have a smartphone, use **Adobe Scan, Cam Scanner** or **Office Lens** app to scan your assignment. They are free, and can create multi-page PDFs. Make sure you install one of these apps in your phone and test it before the deadline to upload the first homework.
- **It is your responsibility to ensure the submission is legible with solutions in the correct order.** You can click on "My Grades" on the left panel of the course homepage to see all your HW submissions.
- Assignments should be uploaded by the deadlines specified on eLearning. Instructions to upload an assignment on eLearning can be found at

  https://www.youtube.com/watch?v=KFbndtgDsQs&t=51s

  Make sure you understand the procedure before the deadline to upload the first homework.
- If you run into technical issues preventing a submission, then e-mail your assignment to me **before the deadline**. **Requesting a late submission because you waited until the deadline to complete your homework is not a legitimate excuse.**

Late/Missed Coursework

- There is no make-up for late or missed assignments, or exams, unless extreme circumstances with proper documentation is accepted by the instructor.
- In cases of extreme circumstances, one is expected to report to me before the deadline of the coursework and resolve the problem within one week after the deadline.

Course and Exam Policies

- Active student participation in class is highly encouraged.
- Homework assignments will be posted on eLearning. You are encouraged to discuss the homework assignments with other students in the class. However, it is expected that you will submit your own write up. Worst homework assignment score will be dropped at the end of semester. The assignments will count as 15% of your course grade.
- NOT all the homework problems will be graded. Typically, **3 homework problems picked at random will be graded from each assignment.**
- Recording of some lectures may be posted on Teams.

- **Problem Bank for each topic will be posted in advance.** You can use it as extra practice material for your exams.
- If you have a legitimate schedule conflict with one of the exams, then contact me at least a week **prior** to the exam date.
- By default, all exams (midterms and final) are closed book. **Only the calculators mentioned in this syllabus can be used on the exam.**
- **Academic dishonesty is taken very seriously and will not be tolerated in this class in any form.**
- The following behavior during an exam is **strictly prohibited**:

  (a) **Use of any class notes or texts;**
  (b) **Use of any website;**
  (c) **Any cell phone use;**
  (d) **Any communication with anyone regarding any portion of the exam;**
  (e) **Transmission of the exam content of any kind (e.g. electronic, verbal, digital).**

  Further information on the academic conduct policy can be found at

  http://www.utdallas.edu/deanofstudents/dishonesty/

- Further instructions about the exams will be given in a separate email close to the date of the exams.

Posting Course Material

Students are strictly prohibited from uploading, posting, or distributing the course material on any platform - digital or otherwise. Violation of this policy constitutes copyright infringement and will result in immediate report to the UTD Office of Community Standards and Conduct.

Comet Creed

This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

"As a Comet, I pledge honesty, integrity, and service in all that I do."

Academic Support Resources

The information contained in the following link lists the University's academic support resources for all students. Please see http://go.utdallas.edu/academic-support-resources.

Official UTD Syllabus Policies and Procedures

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus. Please go to

https://go.utdallas.edu/syllabus-policies/

for these policies.

Please note: The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.