

MA255 Financial Mathematics
Classes meet: Mo, We, Fr 8:00–9:20am in E 382

Spring 2020

Department of Mathematical Sciences
ELIZABETHTOWN COLLEGE

Office hours: Mo,Tu,We,Th, Fr 2:00-3:30pm.

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SYLLABUS

PREREQUISITES: MA117 or MA121

TEXT: Samuel A. Broverman *Mathematics of Investment and Credit*, (7th edition) ACTEX Publications, ISBN: 978-1-63588-221-6

(Remark. The 6th edition of this book is a perfectly fine alternative. The 4th and 5th edition are sufficiently close, but they lack the sections on determinants of interest rates.

CALCULATOR. The only calculators permitted in this course are the ones approved by SOA in their catalog. SOA permits on their exams only the following calculators:

- the battery- or solar-powered Texas Instruments BA-35 model calculator,
- the BA II Plus, the BA II Plus Professional,
- the TI-30Xa or TI-30X II (IIS solar or IIB battery).
- the TI-30XS MultiView (or XB battery)

Candidates may use more than one of the approved calculators during an examination.

For this course you must have the BA II Plus (ordinary or Professional). A TI-30XS MultiView is optional but strongly recommended. Do not buy the TI-30Xa — anything that the TI-30Xa can do, is covered by the BA II Plus already.

COURSE GOALS and COVERAGE. This course has two closely related goals:

- To give an understanding of the mathematical theory of interest and financial mathematics, including measurement of interest, accumulated and present value factors, annuities, yield rates, amortization schedules, sinking funds, bonds, depreciation, yield curves, spot rates, convexity, immunization, factors that determine interest rates.
- To prepare you for the SOA Exam FM.

We will cover most of chapters 1–7 and small parts of chapters 8 of Broverman’s book, as suggested in the SOA catalog.

A detailed list of topics can be found in the schedule on the last page of this syllabus.

STUDENT LEARNING OUTCOMES. By the end of this course you will be able to:

- solve problems in Interest Theory using fundamental concepts of calculus, linear algebra, and discrete mathematics.
- use mathematical software and specialized calculators to solve actuarial problems and demonstrate mathematical ideas.
- apply your learning to situations relevant to actuarial science in the areas of financial mathematics, economics, and corporate finance.
- communicate the results of inductive quantitative analysis effectively, both orally and in writing.
- communicate precise deductive mathematical arguments, both orally and in writing, using professionally accepted conventions of language.
- offer well-reasoned critiques of mathematical arguments presented in professional contexts.
- demonstrate the ability to work cooperatively with others.
- demonstrate the ability to engage in lifelong learning and professional growth.

ASSESSMENT. Your final grade for the course will be based on the degree of mastery of the course content and your progress toward the learning outcomes listed above, as measured by your performance in class, on homework assignments, tests, quizzes, and the midterm and final exam.

ATTENDANCE. You are expected to attend all classes. Excessive absences may result in a lower grade. If you do miss a class, it is your responsibility to obtain from a classmate any notes, assignments, handouts, or anything else you may have missed.

HOMEWORK. Homework will be assigned at every lecture, and will be due at the beginning of the following lecture. You are encouraged to discuss homework problems with each other, but not to copy them from each other. The final write-up must be your own. To receive full credit, solutions must be written clearly and legibly, with enough detail included to indicate the solution method. Homework accounts for 15% of your grade.

Of course, the assigned problems should be considered to be a minimum. You should solve more problems, especially if you don't feel quite comfortable with any section.

TESTS and EXAMS. There will be three in-class tests on the following dates:

FRIDAY, FEBRUARY 14

WEDNESDAY, MARCH 25

FRIDAY, APRIL 24

Each test is timed and will take 80 minutes. This time limit will be strictly enforced.

There will be a comprehensive final exam on FRIDAY, MAY 8 at 7:30 to 10:30 am. Get a good night's sleep before the exam! Note that this date and time have been set by the registrar's office and cannot be changed. Make your travel plans accordingly.

All the tests and exams, as well as the final, are closed-book, in-class exams. No notes, written or electronic, are allowed. All work must be shown to receive full credit.

You should bring your approved calculator(s) to the tests and final exam.

FINAL GRADE. Your final grade will be calculated in the following way:

55% of the grade come from the three Tests, (15% the lowest one, 20% each the other two),

30% of the grade come from the Final Exam,

15% of the grade come from the Homework.

These scores are combined to give a final number of points, between 0 and 100. Point ranges for the final grades are:

A	93-100
A-	90-92.9
B+	87-89.9
B	83-86.9

B-	80-82.9
C+	77-79.9
C	73-76.9
C-	70-72.9

D+	67-69.9
D	63-66.9
D-	60-62.9
F	0-59.9

SCHOOL CLOSURE POLICY. Occasionally, the college is closed and classes are cancelled due to inclement weather or other emergency situations. To minimize the negative impact of such disruptions on your learning, the following School Closure Policy will be in effect for this course. In case of school closure, an alternative form of the lecture will be provided (voice-over slides, instructional video, additional assigned reading, or a combination of these), and you will still need to complete the homework assignment. Concrete details will be communicated to you at the time of the closure announcement. In case the closure falls on an exam day, an alternative date and time for the exam will be announced.

INTEGRITY. All work you submit for grading must be your own and must comply with the Standards of Integrity set forth in the Elizabethtown College Catalog. In particular, no collaboration on quizzes or exams is allowed.

DISABILITIES. Elizabethtown College welcomes otherwise qualified students with disabilities to participate in all of its courses, programs, services, and activities. If you have a documented disability and would like to request accommodations in order to access course material, activities, or requirements, please contact the Director of Disability Services, Lynne Davies, by phone (717-361-1227) or e-mail daviesl@etown.edu.

If your documentation meets the college's documentation guidelines, you will be given a letter from Disability Services for each of your professors. Students experiencing certain documented temporary conditions, such as post-concussive symptoms, may also qualify for temporary academic accommodations and adjustments.

As early as possible in the semester, set up an appointment to meet with me, the instructor, to discuss the academic adjustments specified in your accommodations letter as they pertain to my class.

STATEMENT ON RELIGIOUS OBSERVANCES. The College is eager to facilitate individual religious beliefs and practices whenever possible while retaining course student learning outcomes. It is your responsibility to meet with the class instructor in advance to request arrangements related to your religious observances that may conflict with this class, and to make appropriate plans to make up any missed work.

The most current college policies on Disability Services and Religious Observances can be found at this [link](#).

The following is a tentative schedule. Most of the time, we will be following it closely, but occasional deviations are to be expected.

MA255, Spring 2020

SCHEDULE

Day	Date	Lect	Topic	Sections
Mo	01/13	1	Effective rate of interest	1.1
We	01/15	2	Simple interest vs compounding	1.1
Fr	01/17	3	Accumulated amount function	1.1
We	01/22	4	Present value, equation of value	1.2, 1.3
Fr	01/24	5	Nominal rates of interest	1.4
Mo	01/27	6	Rates of discount	1.5
We	01/29	7	Force of interest	1.6
Fr	01/31		Calculator drill 1: interest	
Mo	02/03	8	Level annuities	2.1,2.2
We	02/05	9	More on level annuities	2.1,2.2
Fr	02/07		Calculator drill 2: annuities	
Mo	02/10	10	More general level annuities	2.2
We	02/12		Review	
Fr	02/14		TEST 1	
Mo	02/17	11	Non-level annuities – geometric	2.3
We	02/19	12	Applications of geometric annuities	9.1, 1.7
Fr	02/21	13	Non-level annuities – arithmetic	2.3
Mo	02/24	14	Continuous investment. Reinvestment yield rate	5.3, 2.3, 2.4
We	02/26	15	Loan amortization	3.1, 3.2
Fr	02/28		Calculator drill 3: loans	
Mo	03/09	16	Other schedules of loan repayment	2.4
We	03/11	17	Bonds: pricing, write-up, write-down	4.1
Fr	03/13	18	Bonds: Book value vs Market value	4.1, 2.4
Mo	03/16	19	Bonds: amortization	4.2
We	03/18	20	Callable bonds	4.3
Fr	03/20		Calculator drill 4: bonds	
Mo	03/23		Review	
We	03/25		TEST 2	
Fr	03/27	21	IRR and NPV	5.1
Mo	03/30		Calculator drill 5: investments	
We	04/01	22	Dollar-weighted and time-weighted rate of return	5.2
Fr	04/03	23	Spot and forward rates of interest	6.1, 6.3
Mo	04/06	24	Commodity forwards and swaps	6.3, 8.1
We	04/08	25	Interest rate swaps	6.3, FM-25-17
We	04/15	26	Duration	7.1
Fr	04/17	27	Convexity and approximation	7.2, FM-24-17
Mo	04/20	28	Convexity and immunization	7.2
We	04/22		Review	
Fr	04/24		TEST 3	
Mo	04/27	29	Factors affecting interest rates	1.8, FM-26-17
We	04/29	30	Components of interest rates	1.8, FM-26-17
Fr	05/01		Review	
Fr	05/08		FINAL EXAM (7:30–10:30am, E 382)	