

ACSI 301: Theory of Interest

2020

Mathematical Interest Theory, Vaaler and Daniel, Chapters 1-9

Financial Mathematics, Solla, Chapters 1-5

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Office hours by appointment at calendly.com/minton/15min

Course Description: An introduction to the mathematical theory of interest. Topics include money growth, investment return, annuities, arbitrage, interest rate sensitivity, and immunization.

Course Objectives: *Learn mathematics used in the actuary profession.* The second test in the actuary field is Exam FM: Financial Mathematics. This tests your knowledge of the basic ways that money is invested, and the ways that investments are evaluated. ACSI 301 prepares you for this test, while covering the basics of financial mathematics including time value of money, annuities, loans, bonds, portfolios, options, and immunizations. (Note: if you're planning to pass Exam FM, you will need to do a lot of extra studying)

Intended Learning Outcomes: At the end of the course, successful students will be able to

- Apply concepts of financial mathematics to calculating present and accumulated values
- Demonstrate proficiency in pricing, asset/liability management, and capital budgeting
- Synthesize partial financial information into a complete financial analysis
- Demonstrate the use of no-arbitrage concepts in financial mathematics
- Demonstrate proficiency of each of the learning objectives at the Society of Actuaries FM webpage

Required Reading:

Mathematical Interest Theory, Vaaler and Daniel

Financial Mathematics, Solla

Equipment: A Texas Instruments BA II Plus calculator or equivalent is highly recommended. The BA II Plus is recommended by the Society of Actuaries for the FM exam.

Attendance Policy: Regular attendance is expected. You must keep up with definitions! You are responsible for everything done in class. If you miss a class, e-mail or call me before class is over and explain why. **If you have two unexplained absences, you will be dropped from the course after a warning email is sent.**

I expect you to spend at least 12 hours of work each week inside and outside of class. You should expect to spend more time on material that is difficult for you.

Academic Integrity: The college policy is fully supported. Tests and are closed notes, closed book. Homework assignments will be discussed in class, and you may always ask me for help. **Do not** collaborate on homework. No electronic devices are allowed in a test situation.

Co-Curricular: During the course of the semester, you must attend at least two approved co-curricular events. There are usually ten or so events in a semester, but do not procrastinate! For each, write a report with (1) a brief summary and (2) a discussion of something that interested you. Due within a week of the event. The event may be a part of the MCSP Conversation Series or an approved event of special interest to ACSI majors.

Study problems and homework: You should attempt as many of the problems in each of the books as possible. Test questions will be modeled on these problems (and Exam FM questions often look like these). In addition, there will be every-other-week homework assignments on problems based on these book problems. Start on these problems early and ask questions!

Tests: We will use the mastery testing method. There will be 26 topics to master. Grading of a problem will be either Mastered or not – no partial credit. You may re-try topics that you did not master previously without penalty. Once you have mastered a topic you do not have repeat that topic. Your overall test/exam grade will be based upon how many topics you master – see the grading scale below. There will be six full test days, with other opportunities in class to repeat topics. On full test days, the first half of the time is devoted to new topics. **Do not plan on falling behind!** Please note that you do not have an infinite set of testing opportunities. We will talk about strategy and status in the course at various times during the semester – the most important message is to keep working and studying! The exam is Thursday, April 23, 2:00-5:00.

Make-ups: In case of sickness or scheduling conflicts, get in touch with me ASAP.

Grading: Homework and co-curricular count 30%. The exam and tests count 70% of the final average. Grades may be curved up based on extenuating circumstances.

A: 93-100 A-: 90-92 B+: 87-89 B : 83-86 B-: 80-82 C+: 77-79 C: 73-76 C-: 70-72
D+: 67-69 D: 63-67 D-: 60-62 F: 59 and below

Special Needs: located in the Goode-Pasfield Center for Learning and Teaching in Fintel Library. Accommodations are provided based on the diagnosed disability and the recommendations of the professional evaluator. In order to be considered for disability services, students must identify themselves to the Office of Accessible Education Services. Students requesting accommodations are required to provide specific current documentation of their disabilities. Please contact Accessible Education Services, at 540-375-2247. If you are on record with Accessible Education Services as having academic or physical needs requiring accommodations, please schedule an appointment with Accessible Education Services soon. You need to discuss your accommodations before they can be implemented. Also, please note that arrangements for extended time on exams, testing, and quizzes in a distraction-reduced environment must be made at least one week *before every exam*.

Topics:

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|--------------------------|----------------------------|
| 1. Basic Interest | 15. Level Annuities |
| 2. Discount Functions | 16. Amortized Loans |
| 3. Compound Rates | 17. Sinking Fund |
| 4. Nominal Rates | 18. Replacement of Capital |
| 5. Force of Interest | 19. Bond Prices |
| 6. Time Value of Money | 20. Bond Amortization |
| 7. Equations of Value | 21. Callable Bonds |
| 8. Investment Return | 22. Brokerage Accounts |
| 9. Yield Rates | 23. Arbitrage |
| 10. Fund Performance | 24. Commodity Futures |
| 11. Annuities | 25. Price Options |
| 12. Deferred Annuities | 26. Derivative Instruments |
| 13. Loan Balances | |
| 14. Annuity Progressions | |

Grading Scale: Master x topics, grade is $22 + 3x$ (e.g., master 13 of 26, grade is 61)

Week 1	Simple Interest	Vaaler 1.3	
	Compound Interest	Vaaler 1.4,1.5	
Week 2	Discount Functions	Vaaler 1.6,1.7	
	Compound discount	Vaaler 1.8,1.9	
	Nominal Rates	Vaaler 1.10	
Week 3	Force of Interest	Vaaler 1.11,1.12	
	TEST #1	Topics 1-4	
	Time Value of Money	Solla chapter 2	
Week 4	Equations of Value	Vaaler 2.2,2.3	
	Investment Return	Vaaler 2.4,2.5	
	Yield Rates	Vaaler 2.6	

Week 5	Fund Performance	Vaaler 2.7	
	TEST #2	Topics 5-9	
	Annuities	Vaaler 3.2,3.3	
Week 6	Deferred Annuities	Vaaler 3.4,3.5	
	Loan Balances	Vaaler 3.6,3.7	
	Geometric Progression	Vaaler 3.8	
Week 7	Arithmetic Progression	Vaaler 3.9	
	Financial Instruments	Solla chapter 3	
	TEST #3	Topics 10-14	
Week 8	Level Annuities	Vaaler 4.2,4.3	
	Amortized Loans	Vaaler 5.2	
	Sinking Fund	Vaaler 5.3,5.4	
Week 9	Replacement of Capital	Vaaler 5.5	
	Bonds	Vaaler 6.2	
	TEST #4	Topics 15-18	
Week 10	Bond Pricing	Vaaler 6.3,6.4	
	Bond Amortization	Vaaler 6.5	
	Callable Bonds	Vaaler 6.7,6.9	

Week 11	Brokerage Accounts	Vaaler 7.1,7.2	
	Arbitrage	Vaaler 8.2,8.3	
	TEST #5	Topics 19-22	

Week 12	Commodity Futures	Vaaler 8.5,8.6	
	Options	Vaaler 8.7,8.8	
	Derivative Instruments	Solla Chapter 4	
Week 13	Asset-Liability Mgt	Solla Chapter 5	
	TEST #6	Topics 23-26	
	Immunization	Vaaler 9.4	

FINAL EXAM: Thursday 4/23, 2:00-5:00