ACSI 301: Theory of Interest   Spring 2024

Contact Me	Meet with Me	Class Info
Name: Dr. Maggie **Pronouns:** She/Her/Hers **Email:** rahmoeller@roanoke.edu	**Office:** Trexler 270B **Student Hours (Drop In!):** Tues 3:00-4:00PM Wed 3:30-4:30PM Fri 9:30-10:30AM	**Location:** Trexler 362 **Days:** MWF **Time:** 2:20-3:20PM

Student Hours Comments:

- The given times above will be consistently available unless emergencies arise.
- These are opportunities for you to ask me questions about material and/or class, including celebrations and concerns.
- Please come prepared to ask your questions – examples of more useful questions include, "I really don't understand how to use the calculator to calculate the effective discount rate. Can you explain it again?" or "What is an annuity? Can you give another example?" Examples of questions that are less useful include, "I'm completely lost. I don't know where to begin. Can you help?" or "I haven't looked at the homework…can you help me?"
- It's always ok to pop by and say, "HI!" – I love getting to know you and chatting with you! But, these have to be short, fun visits ☺ Sadly, none of us have time to sit back and chill anymore. But – please pop by any time for a short 5-10 minute hello. And – never be afraid to come by if you need help ☺

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*. One of the first two tests 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

> Your success in this class is important to me! We all learn differently and bring a variety of strengths and needs to the class. If there are aspects of the course that prevent you from learning or that make you feel excluded, please let me know as soon as possible. Together we'll develop strategies to meet both your needs and the requirements of the course.

Required Materials:

- *Mathematical Interest Theory*, 3rd edition, Vaaler, Harper, and Daniel
- **HIGHLY RECOMMENDED:** A Texas Instruments BA II Plus calculator or equivalent. The BA II Plus is recommended by the Society of Actuaries for the FM exam.

Commitment Hours: This course expects you to spend at least 12 hours of work a week inside and outside of class.

GRADE DISTRIBUTION:
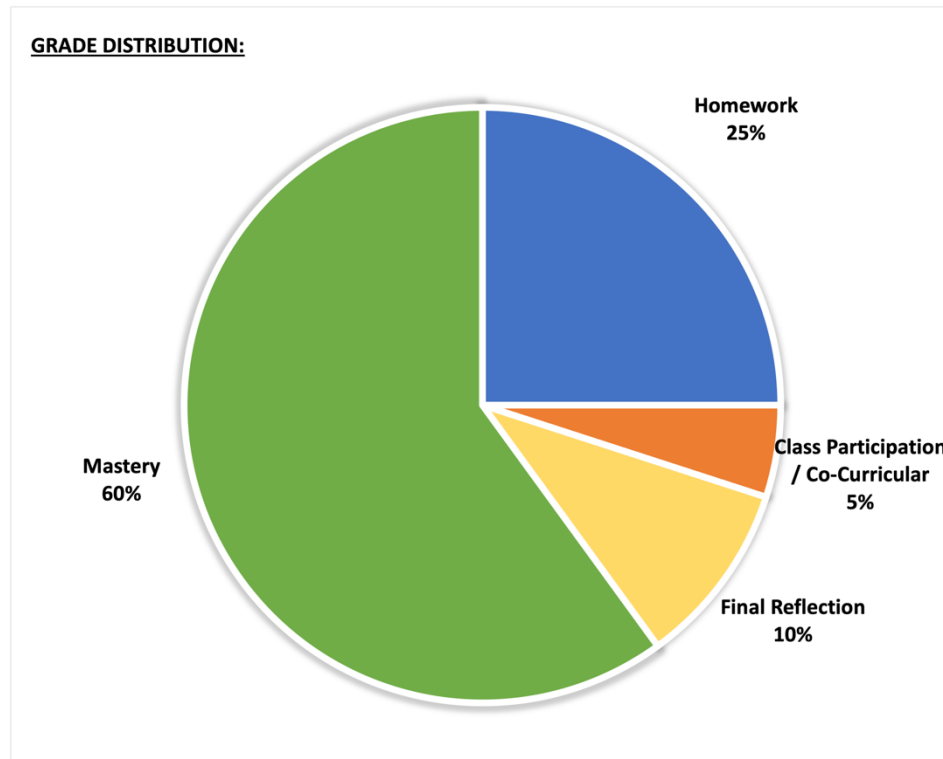
A:	94-100	B:	83-86	C:	73-76	D:	63-66
A-:	90-93	B-:	80-82	C-:	70-72	D-:	60-62
B+:	87-89	C+:	77-79	D+:	67-69	F:	Below 60

Topics:

1. Accumulation Functions
2. Discount Functions
3. Compound Rates
4. Nominal Rates
5. Force of Interest
6. Equations of Value
7. Investment Return
8. Yield Rates
9. Fund Performance
10. Annuities
11. Deferred Annuities
12. Loan Balances
13. Annuity Progressions

14. Level Annuities
15. Amortized Loans
16. Sinking Funds
17. Replacement of Capital
18. Bond Prices
19. Bond Amortization
20. Callable Bonds
21. Brokerage Accounts
22. Arbitrage
23. Rate Swaps
24. Price Options
25. Duration and Convexity
26. Immunization

Mastery Grade: x = # of topics mastered

$$\text{Mastery Grade} = 22 + 3x \ \text{(e.g., master 13 of 26, grade is 61)}$$

COURSE EXPECTATIONS

Classroom Environment: You are expected to treat all students in the class and me with courtesy and respect. Your comments to others should be factual, constructive, and free from harassing statements. You are encouraged to disagree with other students, but such disagreements need to be based upon facts and documentation (rather than prejudices and personalities). My goal is to promote an atmosphere of mutual respect in the classroom. Please let me know if you have suggestions for improving the classroom environment. (Source: Iowa State University)

Diversity and Inclusivity

I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

Attendance Policy: Our course's success depends on you attending class! If you miss class, you will miss community building, engaging conversations, and information that I deem worthy of your time! Plus, we will miss you!

However, life happens! You may get sick, have a game scheduled, or have something else come up. It will not be the end of the world if you miss a class *very occasionally*. At some point, though, missing class can be detrimental to success. So, do your best to be in class! Strive for perfect attendance!

What should you do if you have to miss class? Let me know ASAP! Communication is key! I don't need details (please, spare me the details!) but do let me know ahead of time, so we can make plans, if needed. If you cannot let me know ahead of time (emergencies do happen!), just let me know as soon as you can. Email is typically the best form of communication for me.

If you are sick (and contagious), please either stay home OR come to class wearing a mask (unless you have COVID symptoms – then follow both Roanoke College & CDC guidelines). And be sure to use Health Services on campus!

Late Work: Whether or not to accept late work is always a tough decision. Life happens – and occasionally we need more time to complete tasks! But, sometimes turning in an assignment late causes more complications than benefits.

In this course, we will have a smattering of Homework sets and Mastery Testing:

- I will aim to return homework and post solutions ASAP in this class. **Once the homework solutions have been posted to Inquire, I will not accept your homework.** I do get grumpier when grading late work…so keep that in mind (grumpy Maggie = meaner grader)

- If you know you will be missing a Mastery Testing day, you need to reach out to me ASAP! We need time to figure out when to reschedule that opportunity. If something comes up day of, you need to reach out to me ASAP! Unless it's an emergency, I won't reschedule Mastery if you don't communicate with me prior to the mastery testing day.

> ****In summary, the best thing you can do is *communicate* with me.** Let me know if you have concerns about turning in an assignment on time – I will do my best to work with you.**

Academic Integrity: Students are expected to adhere to the Academic Integrity policies of Roanoke College (https://www.roanoke.edu/inside/a-z_index/academic_integrity). All work submitted for a grade is to be your own work! Mastery Testing is solo work – no book, no notes, no peer help.

Please – work with each other (in pairs or trios) on homework! This doesn't mean you copy another person's work or sit idly while they do the work – rather, chat with each other, brainstorm with each other, and/or look over notes together and ask each other clarifying questions. Write up your work by yourself / individually!! Why participate in active collaboration rather than passive collaboration?
1) You will learn WAY better!
2) It's more fair to your study buddy – why should they do your work for you?
3) It's sounds pretty boring to have to sit there while your study buddy does all the work.

You may use your awesome calculator for any work but note that I may ask for you to show more work with formulas. You can still check your answers with your calculator, but you must do the problem by hand as well. For homework and while studying, you may look at solutions to problems we have done in class, problems that are worked through in the textbook for the course, and class notes. But using unauthorized sources is a violation of Academic Integrity. This includes solutions posted online (not on Inquire), "homework help" sites, and Artificial Intelligence Tools. Uploading our course assignments to these sites is also a violation of Academic Integrity.

WHY? You spend a lot of money attending Roanoke College working toward a (or several) degree(s). Don't you want that degree to mean something? If RC students are only getting degrees by cheating, then does that degree actually mean anything? If we were to get a reputation for a "cheating" school…do you think you'd get a job after Roanoke College?

Besides, I like to be helpful. Ask me for help ☺ I'm only an email away!

COURSE ASSIGNMENTS

Study Problems: You should attempt as many of the problems in the book as possible. Test questions will be modeled on these problems (and Exam FM questions often look like these). These study problems are not to be turned in but ask questions about them!

Homework: Expect to see about 6 HW sets assigned throughout the semester. Some of these problems are tricky: start early and ask questions! You may work in pairs but write up your work individually. See the *Academic Integrity* section of this syllabus.

Mastery Tests: We will use the mastery testing method. There will be 26 topics to master. Grading of each part of a problem will be either Mastered or Not Mastered – no partial credit. You may re-try topics that you did not master previously without penalty. Note that if you get one out of two problems on a topic, you will receive ½ of a mastery. When you re-try that topic, you must do ALL parts of that topic. Your grade will not be lowered on that topic. Once you have mastered a topic you do not have repeat that topic.

You do not need to be perfect on a problem to receive mastery on it. For example, if you use the proper solution technique and make correct assumptions but make a minor arithmetic error, you will still receive credit for that problem. This is an important reason for showing your work, so that I can evaluate whether a mistake is minor or significant.

Your overall test/exam grade will be based upon how many topics you master. There will be six full test days, and perhaps other opportunities to re-try topics. Please note that you do not have an infinite number of testing opportunities. **Do not plan on falling behind!** That strategy does not work!

Final Exam: The final exam period (Thursday, April 25, 2-5PM) will consist of 2 components:
1) Your final opportunity to master topics you have yet to master.
2) A final reflection assignment – you will reflect upon the content in this course and the mastery topics, along with constructing goals for your future with actuarial science.

MCSP Conversation Series: The MCSP+ department and Roanoke College offer many opportunities to engage with mathematical ideas outside of classes. Members of this class are encouraged to attend many of these activities, however attending at least one is mandatory. Examples include MCSP Conversation Series talks, connecting with an actuary through PLACE, and student research showcases - if you're unsure if a given activity makes sense for this purpose, please email me to ask.

Within one week of attendance (to help you remember the event), you must submit a brief response to the activity. This should not simply be a regurgitation of the content, but rather a personal contemplation of the experience.

Additional participation (and submission of reflection papers) will earn you extra credit, with .5% added to your course average for each attended, up to 2% total. In addition, individually, you may request that other appropriate events count.

MCSP Tea Time

Thursdays, 2:20 – 3:20PM   Trexler 271

A chance to chill with peeps while munching on cookies and sipping tea! Often cards make an appearance – or other games! Take an opportunity to relax, have fun, and hang with other students and professors!

RESOURCES

Accessible Education Services (AES) is located in the Goode-Pasfield Center for Learning and Teaching in **Fintel Library**. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. Please contact Dustin Persinger, Assistant Director of Academic Services for Accessible Education, at 540-375-2247 or by e-mail at aes@roanoke.edu to schedule an appointment. If you have registered with AES in the past and would like to receive academic accommodations for this semester, please contact Dustin Persinger at your earliest convenience to schedule an appointment and/or obtain your accommodation letter for the current semester.

Subject Tutoring, located on the lower level of Fintel Library (Room 5), is open 4-9 PM, Sunday-Thursday. Subject Tutors are highly trained, current students who offer free, one-on-one (and small group) tutorials in over 80 courses taught at Roanoke College, including: Business, Economics, Mathematics, INQ 240, Modern Languages, Lab Sciences, and Social Sciences. Check out all available subjects and schedule 30- or 60-minute appointments at www.roanoke.edu/tutoring. If you have a question, feel free to stop by, or contact us at subject_tutoring@roanoke.edu or 540-375-2590. See you soon!

Student Health & Counseling Services supports students through in-person health appointments, in-person counseling, 24/7 telehealth (TimelyCare), Therapy Assistance Online, as well as resources related to general wellness, LGBTQ+, sexual assault, substance abuse, and suicide prevention. Unmet health needs can negatively impact your performance in this course. Student Health & Counseling Services can help. Please see https://www.roanoke.edu/shcs for more information and to access services.

TENTATIVE COURSE SCHEDULE

Date	Mastery Topic	Section	HW Due Dates
1/15	NO CLASS! MLK Jr Day		
1/17	1. Accumulation Functions	Section 1.3	
1/19	1. Basic Interest	Sections 1.4,1.5	
1/22	2. Discount Functions	Sections 1.6,1.7	
1/24	3. Compound Discount	Sections 1.8,1.9	
1/26	4. Nominal Rates	Section 1.10	HW #1
1/29	5. Force of Interest	Sections 1.11,1.12	
1/31	6. Equations of Value	Sections 2.2,2.3	
2/2	**TEST #1**	**Topics 1-6**	
2/5	7. Investment Return	Sections 2.4,2.5	
2/7	8. Yield Rates	Section 2.6	
2/9	9. Fund Performance	Section 2.7	HW #2
2/12	10. Annuities	Section 3.2	
2/14	10. Annuities	Section 3.3	
2/16	**TEST #2**	**Topics 7-10**	
2/19	11. Deferred Annuities	Sections 3.4,3.5	
2/22	12. Loan Balances	Section 3.6	
2.24	13. Annuity Progressions	Sections 3.8,3.9	HW #3
2/26	14. Level Annuities	Section 4.2	
2/28	14. Level Annuities	Section 4.3	
3/1	**TEST #3**	**Topics 11-14**	
	SPRING BREAK!		
3/11	15. Amortized Loans	Section 5.2	
3/13	16. Sinking Fund	Section 5.3	
3/15	17. Replacement of Capital	Section 5.5	HW #4
3/18	18. Bonds	Section 6.2	
3/20	18. Bond Pricing	Sections 6.3,6.4	
3/22	**TEST #4**	**Topics 15-18**	
3/25	19. Bond Amortization	Section 6.5	
3/27	20. Callable Bonds	Sections 6.7,6.9	
3/29	NO CLASS! Good Friday		
4/1	21. Brokerage Accounts	Sections 7.1,7.2	HW #5
4/3	22. Arbitrage	Sections 8.2,8.3	
4/5	23. Rate Swaps	Sections 8.5,8.6	
4/8	**TEST #5**	**Topics 19-22**	
4/10	24. Forward Contracts	Sections 8.9,8.10	
4/12	24. Options	Sections 8.13,8.14	

4/15	25. Duration	Sections 9.2,9.3	HW #6
4/17	26. Immunization	Section 9.6	
4/19	**TEST #6**	**Topics 23-26**	
4/22	26. Immunization	Section 9.6	
4/23	Review		
4/25	**Final Exam**	**2:00-5:00PM**	**Final Reflection**

Study Problems:

Section 1.3	page 71	#2,3,7		Section 5.2	page 256	#1,2,3,4,5
Section 1.4	page 72	#1,2,3,4,5		Section 5.3	page 258	#1,2,3
Section 1.5	page 72	#1,2,3,6,7,8		Section 5.5	page 260	#1,2,4,5
Section 1.6	page 74	#1,2,3		Section 6.2	page 317	#1,2,3,5,6
Section 1.7	page 74	#1,2,3,4,5,7		Section 6.3	page 318	#1,2,3
Section 1.8	page 75	#1,2,3		Section 6.4	page 319	#1
Section 1.9	page 76	#1,2,4,5				
Section 1.10	page 77	#2,3,4		Section 6.5	page 319	#1,2,3,4
Section 1.11	page 77	#1,2,3		Section 6.7	page 320	#1
Section 1.12	page 78	#1,3,4,5,10		Section 6.9	page 322	#1,2,3
Section 2.2	page 111	#1,2,3,4		Section 7.2	page 345	#1,2,3
Section 2.3	page 112	#1,2,3,4,6		Section 8.2	page 434	#1,2
				Section 8.3	page 435	#1,2,3,4
Section 2.4	page 114	#1,2,3,4,5,6				
Section 2.5	page 116	#1,2,3		Section 8.5	page 437	#2
Section 2.6	page 117	#1,2,4		Section 8.6	page 439	#1
Section 2.7	page 117	#1,2,3		Section 8.9	page 441	#1
Section 3.2	page 181	#1,3,4,5		Section 8.10	page 442	#2,3,4
Section 3.3	page 182	#1,2,4,5		Section 8.13	page 444	#2,3,4
				Section 9.2	page 496	#1,2,3,4
Section 3.4	page 184	#1,3,4		Section 9.3	page 497	#1,2
Section 3.5	page 185	#1,2,3,5		Section 9.6	page 499	#1,2
Section 3.6	page 186	#1,2,3,4,6				
Section 3.8	page 189	#1,3,4				
Section 3.9	page 189	#3,5,6				
Section 4.2	page 222	#1a,2,3				
Section 4.3	page 223	#3,5				