Math 418B   Financial Mathematics II

Instructor: Dr. Yvonne Chueh, ASA

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Office Hours: 10:00-10:50AM Monday to Friday, please e-mail to make appointment if you can't make it to my office hour.

Description:
Actuarial financial mathematics, including the value of bonds, methods of measuring interest rates and yield rates of an investment, Term structure of interest, Duration, Convexity and Immunization. Course will be offered every year (Winter).

Prerequisites:
Prerequisite: MATH 418A with a grade of C or higher.

Credits: (4)

Text: 1. Mathematics of Investment and Credit, 7th Edition, Samuel A. Broverman,
          Actex Academic Series
       2. Course Pack
       3. Financial calculator is required

Course Objectives:

This course is required for Actuarial Science majors. As the 2nd part of three-course sequence, it prepares students to pass SOA/CAS Exam FM. This exam is covered by the course sequence Math 418A,B,C (12 credits). After completing the entire sequence, students will be able to calculate present and future values of annuities determined by interest rates. They will be able to apply methods of pricing investment products such as bonds and annuities as well as analyze loans. Students will also be able to solve interest-related problems in investment and asset liability cash flows. Students will gain understanding of financial derivatives (forwards, options, futures, swaps) and their use in risk management.
For math 418B, students will be able to define as well as calculate 1. yield rates, 2. bond price, 3. bond premium, 4. Term structure of interest rates.

Learning Objectives:

A. Bonds

1. Define and recognize Price, Redemption value, Par value/Face value, Coupon, Coupon rate, term of bond, Yield rate, Callable/non-callable, Book value, Accumulation of discount
2. Given any four of price, redemption value, yield rate, coupon rate, and term of bond, calculate the remaining item.

B. General Cash Flows and Portfolios

    1. Define and recognize Yield rate/Rate of return, Dollar-weighted rate of return, Time-weighted rate of return, Current value, Duration (Mccaulay, modified and effective), Convexity, Portfolio and investment year allocation methods, Spot rate, Forward rate, Yield curve, Stock price, stock dividend.

    2. Calculate the current value of a set of cash flows, the portfolio yield rate, the dollar-weighted and time-weighted rate of return, the duration and convexity of a set of cash flows, Macaulay or modified duration given the other, price of a stock using the dividend discount model.

    3. Use duration and convexity to approximate the change in present value due to a change in interest rate.

C. Term Structure of Interest Rates
    1. Yield curves and yield rates, forward rates, and spot rates.

D. Cashflow Duration, Convexity, and Immunization

Topical Outline:

Topic to cover	Days
I. Bond Valuation	
1. Determination of Bond Prices	
2. Finding the Yield Rate of a Bond	
3. Amortization of a Bond	
4. Callable Bonds	9
II. Rate of Return of an Investment	
1. Discounted cash flow analysis	
2. Uniqueness of the yield rate (Internal Rate of Return)	
3. Reinvestment rates	
4. Dollar-Weighted Rate of Return	
5. Time-Weighted Rates of Return	9
III Term Structure of Interest Rates	
1. Yield Curves	
2. Spot Rates	
3. Forward Rates	4
IV Cashflow Duration and Convexity, Immunization	6
TESTING	2
TOTAL	30

Class format

Lecture followed by in-class problem solving. For longer lectures on advanced topics, students are expected to spend extra time on their own to solve related problems. In-class problem-solving time is very limited and based on students learning. Instructor and students present their solutions of the assigned problems and answer questions raised by the instructor and the class. Class pace may be affected by student in-class participation, preliminary reading, and constant review. This is a very fast-paced class so be sure that you follow our schedule consistently.

Attendance

To achieve success in *any* mathematics class, **regular attendance is imperative**. Unlike most subjects, new topics in Financial Mathematics build on previous knowledge; failure to learn something early may haunt you throughout the course. We will do work in class occasionally, so if you missed a class you missed in-class credit.

> **IF YOU MISS CLASS, IT IS YOUR RESPONSIBILITY TO FIND OUT THE MATERIAL COVERED, MEMORABLE, OR ASSIGNED, AND TO ARRANGE TO PICK UP ANY ASSIGNMENTS THAT MAY BE HANDED OUT OR RETURNED!**

Homework

Homework will be assigned in class and the due date will be every Friday. Working on homework is the only way most of us learn to critically analyze and "solve" problems.

Some class time will be devoted to questions on the homework. Office hours are also scheduled to provide opportunities for more in-depth discussion and solving of homework problems.

Grading policy

☐ Assignments and in-class problem solving (100 points; 10-15 points a week)
☐ Three Learning Experiences (300 points)
☐ Final Learning Experience (100 points)

Total 500 points

A perfect score on both of the above categories would result in a total of 500 points. Your course grade will be determined by the percentage p of these points you earn, according the following scale.

$90 \leq p$	A	$65 \leq p < 77.5$	C
$89 \leq p < 90$	A-	$64 \leq p < 65$	C-
$87.5 \leq p < 89$	B+	$62.5 \leq p < 64$	D+
$80 \leq p < 87.5$	B	$50 \leq p < 62.5$	D
$79 \leq p < 80$	B-	$p < 50$	F
$77.5 \leq p < 79$	C+		

Weekly Schedule (Any change of Learning Experience schedule will be announced in class.)

Week	Reading Assignment
1. 1/7-1/10	4.1-4.3
2. 1/13-1/17	4.4-4.6
3. 1/20-1/24	Review **Learning Experience I.**
4. 1/27-1/31	5.1-5.3 (may skip 5.3.2; 5.3.3, 5.3.4)
5. 2/3-2/7	5.4
6. 2/10-2/14	Review
7. 2/17-2/21	6.1, 6.3
8. 2/24-2/28	7.1-7.2
9. 3/2- 3/6	Review **Learning Experience II.**
10. 3/9-3/13	Review **Final Presentation**
11. 3/16-3/20	**Final Learning Experience**

Academic Integrity
Actuarial professionals in general, and Credential Actuaries in particular, have reputations for working hard, being objective, and having integrity.

The grading policy for all actuarial courses is based on strict compliance with WAC 106-120--- STUDENT JUDICIAL CODE, especially Part II, Sub-part B, regarding ACADEMIC DISHONESTY. A student who violates this Code WILL RECEIVE A GRADE OF F IN THIS CLASS, and will be subject to further disciplinary action in accordance with University Policy (WAC 106-72-005).

Expectations for Student Conduct

Students in this class are expected to interact with students and the professor professionally. Instances of disruptive conduct, obstructive conduct, or harassment will be referred to the Dean of Student Success.

Per WAC 106-125-020, the term ``disruptive'' or ``obstructive'' conduct means conduct, not protected by law, that interferes with, impedes, or otherwise unreasonably hinders the normal teaching, learning, research, administrative, or other functions, procedures, services, programs, or activities of the university. The term includes disorderly conduct, breach of the peace, violation of local or university noise policies, lewd or obscene conduct, obstruction of pedestrian or vehicular traffic, tampering with student election processes, or interfering

with the orderly conduct of university investigations or disciplinary proceedings, including interfering with or retaliating against any witness, party, or other participant.

The term ``harassment'' means unwelcome and offensive conduct, including verbal, nonverbal, or physical conduct, that is directed at a person because of such person's protected status and that is sufficiently serious as to deny or limit the ability of a student to participate in or benefit from the university's educational program, or that creates an intimidating, hostile, or offensive environment for any campus community member(s). Protected status includes a person's actual or perceived race, color, national origin, gender, disability, or other status protected by law.

CWU expects every member of the university community to contribute to an inclusive and respectful culture for all in its classrooms, work environments, and at campus events. As a student in this course, you are expected to treat your professors, fellow students, and other people affiliated with your work at CWU with respect, regardless of their sex, race and color, religion and creed, national origin, sexual orientation, gender identify and gender expression, disability and use of assistive devices or a service animal, and veteran or military status.