Math 418B Financial Mathematics II
Lind Hall 104, 2:30 – 3:45 (M,W)

Instructor: Dr. Yvonne Chueh, ASA, MAAA

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Office Hours: 11:00-11:50 AM Monday to Friday, e-mail or call to make appointment or ask questions. Students welcome when my office door is open! Check out http://www.cwu.edu/~chueh for my daily schedule.

Prerequisite: MATH 418A or Permission.

Text: Mathematics of Investment and Credit, 4th Edition, Samuel A. Broverman, Actex Academic Series

Course Objectives:

This course is required for Actuarial Science majors/specializations. 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 (9 credits). It's followed by the new course Math 440 Financial Economics (5 credits) covering Exam MFE. 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 and sinking funds. Students will also be able to solve interest-related problems in the actuarial professional. 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. price and payment for general annuities, 2. yield rates, 3. sinking fund deposit and balance, 4. bond price, 5. bond premium, 6. immunization strategy.

Learning Objectives:

A. Loans

1. Define Principal, Interest, Term of Loan, Outstanding Balance, Final Payment (drop payment, balloon payment), Amortization, Sinking Fund.
2. Given any four of term of loan, interest rate, payment amount, payment period, principal, calculate the remaining items.
3. Calculate the outstanding balance at any time point during the loan period.
4. Calculate the principal portion and interest portion of a given payment.
5. Evaluate a sinking fund,

B. 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.

C. 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.

D. Immunization

1. Define and recognize Cash-flow matching, immunization, Redington immunization
2. Construct an investment portfolio to fully immunize a set of liability cash flows
3. Construct an investment portfolio to exactly match a set of liability cash flows.

Topical Outline:

	Topic to cover	Days
I	Loan Repayment	
	1. Loan Balance	
	2. Amortization	
	3. Sinking Fund Method of Loan Repayment	6
II.	Bond Valuation	
	1. Determination of Bond Prices	
	2. Finding the Yield Rate of a Bond	
	3. Amortization of a Bond	
	4. Callable Bonds	9
III.	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
IV	Immunization	
	1. Asset Liability Cash Flow Matching	
	2. Durations	
	3. Full Immunization	3
	TESTING	3
	TOTAL	30

Class format

Lecture followed by in-class problem solving with students' input and textbook reading as expected. For longer lecture explanations on advanced topics, students are expected to spend extra time on their own to seek and solve related problems. In-class problem-solving time is very limited and subject to students' learning progress. 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 but it can be adjusted by the instructor based on student feedback during the course and ultimate course goals.

Attendance

To achieve success in *any* mathematics class, **regular attendance is almost 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, ANNOUNCED, OR ASSIGNED, AND TO ARRANGE TO PICK UP ANY ASSIGNMENTS THAT MAY BE HANDED OUT OR RETURNED!

Homework policy

Homework has been assigned on the syllabus below and the due date will be every Friday by noon. A neat homework book needs to be kept for the quarter to track problems done completely and make up missed problems. 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 of homework problems.

There may be problems to be worked during class to turn in. Poor attendance regularly will affect your homework grade.

Grading policy

- Textbook Assignments and in-class problem solving (150 points)
  - Approximately 15 points are due each week by Friday noon. No point for late turn-in.
  - Extra points for excellent work for posting online.
- Three Learning Experience (300 points)
- Final Learning Experience (100 points)

Total 550 points

Tentative Schedule (Any change will be announced in class.)

Week	**Reading Assignment**	**Homework**
1. 1/4-1/7	3.1-3.2	3.1 #1-10; 3.2 #1-9, 11-18, 20-22
2. 1/10-1/14	3.3, 3.5 (Skip 3.4)	3.3 #1, 3, 4,6
3. 1/17-1/21	Review (Martin Luther) **Learning Experience I**.	
4. 1/24-1/28	4.1-4.2	4.1 #1-22, 24, 25 4.2 #1-5, 7, 9
5. 1/31-2/4	4.3 (Skip 4.3.2)	4.3 #1-4
6. 2/7-2/11	Review	
7. 2/14-2/18	**Learning Experience II.**	
8. 2/21-2/25	5.1-5.2 (Skip 5.1.4) (Presidents')	5.1 #3,4,6(d),9,12 5.2 #1-6
9. 2/28-3/4	5.3 (Skip 5.3.2)	5.3 #1,2
10. 3/7- 3/11	**Learning Experience III.** 7.1-7.2	7.1 #1-3,5-8,10,12,13 7.2 #1,2,5,6,7,10,12,13
11. 3/14-3/18	**Final Learning Experience**	