MATH 3160: Mathematical Theory of Interest

2023 Summer Session	
Total Class Sessions: 25	Instructor: Staff
Class Sessions Per Week: 5	Classroom: TBA
Total Weeks: 5	Office Hours: TBA
Class Session Length (Minutes): 145	Language: English
Credit Hours: 4	

Course Description:

This course is about mathematical theory of interest, introducing the financial mathematical concepts and its application to investment and corporate finance. Along with the understanding on probability, this course is designed to help students prepare for taking the Financial Mathematics Exam, which is also refer to FM exam by SOA (Society of Actuaries) and EXAM 2 by the CAS (Casualty Actuarial Society).

It is quite recommended that students can use the Texas Instruments BAII Plus or Texas Instruments BAII Plus Professional calculator. The textbook gives a detailed instructions on how to use the calculators in the beginning.

Course Materials:

Mathematical Interest Theory (Mathematical Association of America Textbooks), 2nd Edition, by Leslie Vaaler (Author), James Daniel (Author)

Publisher: American Mathematical Society; 2 edition (February 19, 2009)

Language: English

ISBN-10: 0883857545

ISBN-13: 978-0883857540

Or

Mathematical Interest Theory: (AMS/MAA Textbooks), 3rd Edition, by Leslie Jane Federer Vaaler (Author), Shinko Kojima Harper (Author), James W. Daniel (Author)

Publisher: American Mathematical Society; 3 edition (December 9, 2019)

Language: English

ISBN-10: 1470443937

ISBN-13: 978-1470443931

Recommended Text:

ACTEX Study Manual for the SOA Exam FM and CAS Exam 2, Samuel A. Broverman, ACTEX Publications

Course Format and Requirements:

All students are expected to attend class actively with no absence. A students who is absent for a

exam will definitely not be permitted to take a make-up exam for any reason. In case of some special circumstance and students are unable to take the exam, students shall inform his instructor in advance and get the written permit.

Each students is required to bring an approved calculator to every class session. No graphing calculators or cell phones calculators will be allowed. Even though Texas Instruments has a nice app that replicates the calculator, but it is absolutely not allowed on exams in class or on the Actuarial exam.

Course Assignments:

Chapter Quizzes (15%):

Quiz will be posted online or assigned in the first 15 minutes of each class. Each quiz will cover the key concepts in previous chapter and to enhance students' understanding on course content. Some quizzes questions will be selected from SOA exams before. The quizzes will be consist of multiple choice questions and/or short answer questions. There will be no make-up quiz.

Problem sets (15%):

There are 5 problem sets All assignments must be turned in at the start of class on their due date. Late work will not be accepted. Students are encouraged to work together on the problem sets, but each student must turn in individual work. Problem sets are graded on accuracy as well as on effort. Answers that are vague, difficult to read, or appear incomplete will not receive full credit.

Midterm Exams & Final Exam (20%+ 20%+30%):

Exams will be held in class. Exam 1 will cover topics from chapter 1 to chapter 4 (time value of Money and Annuities. Exam 2 will cover topics in chapter 5 and 6 (Loans and Bonds). Final Exam is cumulative and will cover all topics in the book.

There is absolutely no sharing of information sheets, calculators, or other resources during the exam. Cell phones may not be used as calculators. Any violation of these rules will result in a grade of 0 for all involved parties.

Course Assessment:

Quizzes	15%
Problem sets	15%
Midterm Exams 1	20%
Midterm Exams 2	20%
Final Exam	30%
Total	**100%**

Grading Scale (percentage):

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
98-100	93-97	90-92	88-89	83-87	80-82	78-79	73-77	70-72	68-69	63-67	60-62	<60

Academic Integrity:

Students are encouraged to study together, and to discuss lecture topics with one another, but all other work should be completed independently.

Students are expected to adhere to the standards of academic honesty and integrity that are described in the Chengdu University of Technology's *Academic Conduct Code.* Any work suspected of violating the standards of the *Academic Conduct Code* will be reported to the Dean's Office. Penalties for violating the *Academic Conduct Code* may include dismissal from the program. All students have an individual responsibility to know and understand the provisions of the *Academic Conduct Code.*

Special Needs or Assistance:

Please contact the Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material. Our goal is to help you learn, not to penalize you for issues which mask your learning.

Course Schedule:

(There are 25 class session in total).

Course overview and An introduction to the Texas Instruments BA II Plus

Chapter 1: The growth of Money (**Mathematical Interest Theory, 2nd Edition**)
1.1 Introduction
1.2 What is Interest?
1.3 Accumulation and amount functions
1.4 Simple interest/Linear accumulation functions
1.5 Compound interest
1.6 Interest in advance/The effective discount rate
1.7 Discount functions/The time value of money
1.8 Simple discount
1.9 Compound discount
1.10 Nominal rates of interest and discount
1.11 Constant force of interest
1.12 Force of interest
1.14 Inflation
SOA exam questions practice

Chapter 2: Equations of Value and Yield Rate (**Mathematical Interest Theory, 2nd Edition**)
2.1 Introduction

2.2. Equations of value for investments involving
a single deposit made under compound interest
2.3 Equations of value for investments with multiple contributions
2.4 Investment return
2.5 Reinvestment considerations
2.6 Approximate dollar-weighted yield rates
2.7 Fund performance
SOA exam questions practice

Chapter 3: Annuities(annuities certain) (**Mathematical Interest Theory, 2ⁿᵈ Edition**)
3.1 Introduction
3.2 Annuities immediate
3.3 Annuities due
3.4 Perpetuities
3.5 Deferred annuities and values on any date
3.6 Outstanding loan balances
3.7 Nonlevel annuities
3.8 Annuities with payments in geometric progression 1,
3.9 Annuities with payments in arithmetic progression
3.11 Annuity symbols for nonintegral terms
3.13. The investment year method
SOA exam questions practice

Chapter 4: Annuities with different payment and conversion period (**Mathematical Interest Theory, 2ⁿᵈ Edition**)
4.1 Introduction
4.2 Level annuities with payments less frequent than each interest period
4.3 Level annuities with payments more frequent than each interest period
4.4 Annuities with payments less frequent than each interest period and payments in arithmetic progression.
4.5 Annuities with payments more frequent
than each interest period and payments
in arithmetic progression.
4.6 Continuously paying annuities
4.7 A Yield Rate Example
SOA exam questions practice

Chapter 5: Loan Repayment (**Mathematical Interest Theory, 2ⁿᵈ Edition**)
5.1 Introduction

5.2 Amortized loans and amortization schedules
5.3 The Sinking Fund method
5.4 Loans with other repayment patterns
SOA exam questions practice

Chapter 6: Bonds (**Mathematical Interest Theory, 2nd Edition**))
6.1 Introduction
6.2 Bond alphabet soup and the basic price formula
6.3 The premium-discount formula
6.4 Other pricing formulas for bonds
6.5 Bond amortization schedules
6.6 Valuing a bond after its date of issue
6.7 Selling a bond after its date of issue
6.8 Yield Rate Example(excluding example 6.8.1)
6.9 Callable bonds
SOA exam questions practice

Chapter 7: Stocks and Financial Martets (**Mathematical Interest Theory, 2nd Edition**)
7.1 Common and preferred stock
SOA exam questions practice

Chapter 8: Term Structure of Interest Rate and Derivatives(**Mathematical Interest Theory, 2nd Edition**)
8.3 The Term Structure Only
8.11 Swaps

Chapter 9: Interest Rate and Sensitivity(**Mathematical Interest Theory, 2nd Edition**)
9.1 Overview of interest rate sensitivity
9.2 Duration
9.3 Convexity
9.4 Immunization