MATH 3356– Quant Theory of Interest

Time & Place: TR 9:30 AM-10:50 AM in MATH 112

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Office Hours: TR 2:00-3:00 PM

Textbook: The Theory of Interest, by S. Kellison, 3rd Ed.

Course Goals: This course covers the mathematical theory of interest. It is recommended for students who plan to take the Exam FM given by the Society of Actuaries (SOA). This course is required for the Actuarial Science minor.

Calculator A financial calculator is required for this course. A Java script web financial calculator is provided at

Calculator

for all the in-class calculations. Students can use it for the Homework assignments, tests, and the final exam. It can be down loaded to your phone or computer to use off-line.

Course Outline The information below serves a tentative time line for the material to be covered: Week 1 & 2:

Simple interests and compound interests.

Week 3:

Present values, effective rates of discount, nominal rate of interest and discount, force of interest. Week 4:

Varying interests, equation of values, unknown time.

Midterm Test-1

Week 5:

Unknown rate, determine time periods, annuity immediate, annuity due.

Week 6:

Annuity values on any date, perpetuities, unknown time of an annuity, unknown rate of an annuity, varying interest annuities.

Week 7:

Different payment and interest conversion periods, continuous annuities, payments varying in arithmetic progression.

Week 8:

Payment varying in geometric progression, continuous varying annuities, outstanding loan balance.

Midterm Test-2

Week 9:

Amortization schedules, sinking funds.

Week 10:

Differing payment periods and interest conversion periods, varying series of payments.

Week 11:

Securities, price of a bond. Premium and discount bonds, valuation between coupon payment dates.

Week 12:

Determination of yield rates, callable and putable bonds, other securities.

Midterm Test-3

Week 13:

Net present values, dollar weighted and time weighted yield rates, yield curve and spot rates, forward rates, interest rate swap.

Week 14:

Macaulay and modified durations and convexities, first-order Macaulay and modified approximations, cash-flow matching, Redington immunization, full immunization.

Week 15:

Selected EXAM FM sample questions.

Attendance: Attendance will be taken every meeting and is mandatory. It is worth the bonus 5% of the total grade. For example, if your attendance is 25 out of the total 38 meetings, your attendance grade will be

$$\frac{25}{38} \times 5\%.$$

On the other hand, students with excessive absence will be reported to the students' academic dean.

Homework: The homework assignment score accounts for 25% of the total score. Online homework system WeBWorK is used for this course. The WeBWorK link for this course is at

https://webwork.math.ttu.edu/webwork2/f24homeim3356s001/

Students are encouraged to print out the problems and work them off-line. Answers for any question can be submitted unlimited times before the due time. It is strongly recommended to finish each assignment by its due time. After the due time, the assignment will be closed. If for some reason you can not make 100% correct on a particular assignment, you can still work on the problem you missed and check whether the answer is correct or not. So please keep working on any uncompleted assignments and keep a paper copy of the correct answers for future submission even after they are closed. All the homework assignments will re-open on Dec 7 and Dec 8 for students to submit missed answers for credit. Note that this period is only for submitting answers. Do not wait until that time to do any of previous assignments. You will not have enough time to finish them before the Final Exam. Also, you cannot do well on the Midterm Tests if you do not finish the corresponding homework assignments.

Midterm Tests: Three midterm tests are worth $15\% \times 3$ of the total score. Each will be administered on the following days through WeBWork. Each Midterm test is due 1 day after it is open.

Midterm Test-1: Chapter 1-4. Midterm Test-2: Chapter 5-8. Midterm Test-3: Chapter 9-12.

Final Exam: The final exam is comprehensive and will be worth 30% of the total score. It consists of 30 multiple choice questions from HW1-HW13. Students can take it three times within the 24-hour period and the time limit for each take is 180 minutes. The score will be the highest of the three.

Final Exam Time: Monday, Dec 9, 7:30AM- Tuesday, Dec 10, 7:30AM.

Grading Scale:

 $\begin{array}{l} {\rm A:} \geq 90\% \\ {\rm B:} \geq 80\% \ \& < 90\% \\ {\rm C:} \geq 70\% \ \& < 80\% \\ {\rm D:} \geq 60\% \ \& < 70\% \\ {\rm F:} < 60\% \ {\rm or \ Missing \ the \ Final \ Exam.} \end{array}$