# KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
## DEPARTMENT OF MATHEMATICS & STATISTICS
### DHAHRAN, SAUDI ARABIA

## AS289: Actuarial Science Problem Lab I - FINANCIAL MATHEMATICS (212)

**Course Objectives:**
This problem lab is designed to prepare Actuarial majors for the second Society of Actuaries and Casualty Actuarial Society Examinations, FM (Financial Mathematics). Participation in this course does not guarantee a student will pass the FM exam but this course provides a good start in preparing students towards that goal.

**Textbook and Package:**
1. Hasset, M. J., Ratliff, M.I., Garcia, T. C., and Steeby, A. C. (2014) *ACTEX FM/2 Study Manual*, 2011th edtion. ACTEX Madriver.
2. **SOA approved Calculator (such as TI BA II Plus)**

**Reference:**
1. Mathematics of Investment and Credit, 7th edition, by Broverman, S.A., ACTEX Publications Inc. (2017).

**Instructor**: Dr. Mohammad H Omar          **Office:** Bldg – 5, room – 508.     **Phone:** 2471
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**Office Hours: UT: 12:30 pm - 1:45 pm or by appointment.**

*Assessment*

Assessment for this problem lab will be based on quizzes, attendance, labwork, two major exams and a comprehensive final exam, as in the following:

| Activity | Weight |
|---|---|
| Lab Quizzes[1], attendance, and LabWork | (15%+2%+8%) |
| Exam 1 (Chapters 1 thru 3) <br> **Sunday Feb 20, 2022 , 7.00 pm, in Building TBA** | 22% |
| Exam 2 (Chapters 4 thru 6) <br> **Wednesday, Mar 9, 2022, 6:30 pm, in Building TBA** | 23% |
| Final Exam (Comprehensive) <br> **TBA in Building TBA** | 30% |

**IMPORTANT NOTE on GRADES:** Students who miss 3 or more meetings will receive a **DN** grade. Students with **less than 50% total score** will receive an **F grade**. Students who obtain **more than 90%** on the class total will obtain an **A+** grade. Other grades starts as follows: **D (50%), D+(55%), C(60%), C+(70%), B(75%), B+(80%),** and **A(85%).**

**Alternatively** if a student, who registers for this course and regularly attends class, signed up for and passed the SOA FM exam with written proof of this pass **before the end** of the semester, the student's grade for this course will be **A.** However, if the student does not attend **more than 3 classes**, his final grade will be reduced to **DN in adherence to university policy**. If the student prefers the **A+** grade, he is expected to fully participate and motivate his fellow students in the problem-solving labs.

*General Notes:*
- Social distancing is required in every class during this trying time of the Coronavirus pandemic.
- Students are required to carry **pens, note-taking equipment** and a **calculator** to **EVERY lab, quizzes, and exams**. It is strongly recommended to keep a **binder for solved problem and lab-notes** for FM preparation.
- Students are also expected to take class notes and organize their learning material in a **binder** for easy retrieval to help them in study and review for class, exams, etc
  o It is to the student's advantage to keep a binder for storing class notes, homework, and other graded assignments. Students who are **organized** will find it **easier** to find important materials when **studying for exams**.
- To successfully learn financial mathematics, students MUST **solve problems** and **analyze data**. The selected assigned problems are specifically designed to prepare you for class quizzes, lab, majors and final exam. So, it is expected that you complete these problems **step-by-step** and with comprehension. If you happen to stumble upon a written solution, remember 2 important points. (1) these solutions are brief and may have mistakes and (2) you are expected in your career as an actuary and your exams and quizzes in this preparation class to know every step to a

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[1] Once a chapter is completed, you should expect a class quiz.

problem and to know when a solution is incorrect. Thus, the best way to solve problem is without these brief solutions.

- *__Never round__* your intermediate results to problems when doing your calculations. This will cause you to lose calculation accuracy. Round only your final answers and you should not round less than 4 decimal places unless required otherwise.
- For every exam, so you need to bring with you *__pens__*, *__pencils__*, *__a sharpener__*, *__an eraser__*, and a *__calculator__*.

**Academic Integrity**: All KFUPM policies regarding **ethics** and **academic honesty** apply to this course.

*Important Notes:*
- ✓ In accordance with University rules, *__20% or 3 (THREE) unexcused absences__* will automatically result in a grade of *__DN__*. This grade will take effect as soon as one week after the 3 absences are recorded.
- ✓ *__Attendance__* on time is *very* important. Mostly, attendance will be checked within the *first five minutes* of the class. Entering the class after that, is considered as one late, and *every two times late* equals to one absence.

*Home Work Problems:*
- ➢ Handout problems will be posted on the WebCT towards the end of each chapter.
- ➢ The *__Homework__* should be submitted in the first Saturday after completing the chapter *and no need for an announcement in advance*.
- ➢ No late homework will be accepted.

*Student Learning Objectives:* (Consistent with **SOA professional exam FM** objectives).

It is the student's responsibility to solve FM exam problems to be familiar with the format on this SOA professional exam. Generally speaking, students should expect to spend around a total of 300 hours of preparation to pass the SOA exam (around 15 weeks of 3 hours of daily studying).

By completing this course, students should be able to
- ➢ *Know* **definitions** of key terms of financial mathematics:
    a. Inflation; rates of interest [simple, compound (interest and discount), real, nominal, effective, money- or dollar-weighted, time-weighted, spot, forward], term structure of interest rates; force of interest (constant and varying); equivalent measures of interest; yield rate; principal;
    b. Equation of value; present value; future value; current value; net present value; accumulation function; discount function;
    c. Annuity certain (immediate and due); perpetuity (immediate and due);
    d. Stocks (common and preferred); bonds (including zero-coupon bonds); other financial instruments such as mutual funds, and guaranteed investment contract
- ➢ *Understand* key **procedures** of financial mathematics: determining equivalent measures of interest; discounting; accumulating; determining yield rates; estimating the rate of return on a fund; and amortization
- ➢ *Calculate* the equivalent **annual** effective rate of interest, given a nominal annual rate and a frequency of interest conversion, discrete or continuous, other than annual
- ➢ *Calculate* the equivalent effective rate of investment per payment period given a payment period different from the interest conversion period.
- ➢ *Calculate* the amount(s) of investment returns, given there is more than one return, and given a set of yield rates, the amount(s) and timing of investment contribution(s) and the desired timing of the investment returns
- ➢ *Calculate* the term of an investment, given a set of cash flows (level or varying), and a set of interest rates (level or varying);
- ➢ *Know* **definitions** of key terms of *modern* financial analysis at an introductory and intuitive level,
- ➢ Complete basic *calculations* involving such terms: yield curves, spot rates, forward rates, duration, convexity, and immunization.

# Syllabus (Tentative)

| Week | Module | Discussion Topics | Notes |
|---|---|---|---|
| **1** 20-Jan | 1 | Interest Rate and Time Value of Money | |
| **2** 27-Jan | 2 | Annuities | |
| **3** 3-Feb | 3 | Loan Repayment | |
| **Wednesday, Feb 9 1st Major Exam (Module 1 through 3)** | | | |
| **4** 10-Feb | 4 | Bonds | |
| **5** 17-Feb | 5 | Yield rates of an Investment | |
| **6** 24-Feb | 6 | Term Structure of Interest Rates | |
| **7** 3-Mar | 7 SOA approximation | Asset Liability Management, Duration, and Immunization | |
| **Wednesday, Mar 9 - 2-nd Major Exam (Mod 4 thru 6)** | | | |
| **8** 10-Mar | 14 | Swaps | |
| **9** 17-Mar | SoA Handout | SoA interest Determinants | |
| **10** 24-Mar | PR1 | Practice Problem 1 | |
| **11** 31-Mar | PR1 | Practice Problem 1 (cont) | |
| **12** 7-Apr | PR2 | Practice Problem 2 | |
| **13** 14-Apr | PR2 | Practice Problem 2 (cont) | |
| **14** 21-Apr | PR3 | Practice Problem 3 | **Thurs Apr 21:** Last date to declare "Pass" of SOA FM exam to obtain the A grade. |
| **15** 12-May | PR3 | Practice Problem 3 (cont) | |
| **Final Exam (Comprehensive): TBA** | | | |