

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

AS201: FINANCIAL MATHEMATICS (141)

Course Objectives:

The course concentrates on the theory of compound interest and the mathematics of investment and credit; however, life contingencies are also introduced toward the end of the semester. Major topics include the measurement of interest, annuities certain (level, non-level, and continuous), amortization schedules, sinking funds, investment yield rates, and valuation of bonds and other securities. A basic knowledge of calculus and probability is assumed. Methods of loan measurement and payments (Islamic and Conventional) are illustrated in amortization and sinking fund schedules. Islamic views on interest and investments will be discussed. This course is intended for Actuarial Science and Financial Mathematics majors who are studying for the professional exam on (FM) given by the Society of Actuaries and the Casualty Actuarial Society.

[AS201-Financial Mathematics](#)

Prerequisites: MATH 102

Textbook and Package:

1. Mathematics of Investment and Credit, 5th edition, by Broverman, S.A., ACTEX Publications Inc. (2010).
2. **R software** (freely downloadable at <http://cran.r-project.org/bin/windows/base/>) and **MATHEMATICA** (available for use at building 14)
3. **Calculator** (BA II Plus calculator or check for other SOA approved calculators)

Reference:

McDonald, R. (2006) *Derivatives Markets* (2nd Edition) Addison-Wesley/Prentice Hall

Instructor: Dr. Stephen Binns **Office:** Bldg – 5, room – 331. **Phone:** 2720

E-mail: binns@kfupm.edu.sa (Not by WebCT/Blackboard email)

Office Hours: UTR: 10:00 am - 12:00 pm or by appointment.

[Assessment](#)

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

Activity	Weight
Quizzes, attendance, and homework	(10%+2%+8%)
Exam 1 (Chapters 1 & 2) Tuesday (Oct 2 – week 5) , 6.00 pm, in Building 5	22%
Exam 2 (Chapters 3, 4, & 5) Tuesday (Nov 27 - week 11), 6:30 pm, in Building 5	23%
Final Exam (Comprehensive) 7.30am Wed Jan 2 (as posted on registrar website)	35%

IMPORTANT NOTE on GRADES: Students who miss 9 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%)**. There is no quota on the number of students who can get an A+ grade.

[General Notes:](#)

Students are required to carry **pens, note-taking equipment** and a **calculator** to **EVERY lecture, quiz, and exam**.

To successfully learn financial mathematics, students **MUST** solve problems. 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. Do not use solution manuals. They inhibit your learning.

For every exam, so you need to bring with you **pens, pencils, a sharpener, an eraser,** and your **calculator**.

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

Important Notes:

- ✓ In accordance with University rules, **9 (NINE) unexcused absences** will automatically result in a grade of **DN**.
- ✓ **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.

Homework Problems:

- Handout problems will be posted on the WebCT or in the instructor home page towards the end of each chapter.
- The **Homework** should be submitted in the first Sunday 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).

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, immunization, and short sales.

Syllabus

<i>Week</i>	<i>Sections</i>	<i>Topics</i>	<i>Notes</i>
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1 (Aug 31- Sep 4)	1.1-1.2	Measurement of Interest and Investment Rate. Introduction. Accumulation and Effective rates. Present Values.	3 Sept Last day for late registration; Last day for adding courses.
2 (Sept 7-11)	1.3-1.6	Equation of Value. Nominal Rates. Effective and Nominal Discount rates. Force of Interest.	11 Sept Last day for dropping course(s) without permanent record
3 (Sept 14-18)	1.7-1.9 2.1	Inflation and "real" rate. Notes and References. Valuation of Annuities Level Annuity Payments.	
4 (Sept 21-25)	2.2-2.4, 2.6	Generalized payments. Non-constant payments. Applications and Illustrations. Notes and References.	Sept 23: National Day
Id al-Adha Vacation Sept 26 – Oct 11			
<u>Tuesday, Oct 14 – 1st Major Exam (chapters 1,2)</u>			
5 (Oct 12-Oct 16)	3.1-3.4, 3.6	Loan Repayment. Amortization method. Level payments. Sinking Fund. Applications and Illustrations. Notes and References.	Midterm grade reports due.
6 (Oct 19-23)	4.1-4.3, 4.5	Bond Valuation Bond Price Determination. Bond Amortization. Applications and Illustrations. Notes and References.	23 Oct: Last day to Drop courses with grade of "W" online
7 (Oct 26-30)	5.1-5.3, 5.5	Measuring the Rate of Return of an Investment Internal Return Rate. Net Present Value. Money-weighted and time-weighted return rate. Applications and Illustrations. Notes and References.	
8 (Nov 2-6)	6.1-6.4,	The Term Structure of Interest & Investment Rates Spot Rates. Spot Rates vs Yield to Maturity on Coupon Bonds. Forward rates.	
<u>Tuesday, Nov 4- 2nd Major Exam (chapters 3, 4, 5)</u>			
9 (Nov 9-13)	6.4, 6.6 7.1	Apps and Illustrations (incl arbitrage). Notes and Ref. Cash-flow Duration and Immunization Cash-flow and Bond Durations	
10 (Nov 16-20)	7.2-7.3, 7.5 8.1-8.3	Asset-Liability Matching and Immunization. Apps and Illustrations (incl changes in yield). Notes and Ref. Additional Topics in Finance and Investment Stock Dividend Discount Model. Short Sales. Additional Equity Investments.	21 Nov: Last day to withdraw from all courses with grade of "W" thru the Univ. Registrar Office
11 (Nov 23-27)	8.4-8.6 9.1	Fixed Income Investments. Notes and Ref. Derivatives: Forward, Futures, Swaps, and Options. Forward and Future Contracts.	
12 (Nov 30–Dec 4)	9.1-9.2	Forward and Future Contracts (cont.). Options.	
13 (Dec 7-11)	9.3-9.5	Option strategies. (+ Black-Scholes Option Pricing). Foreign Currency Exchange Rates. Notes and References.	
14 (Dec 14-18)	Guest Material	Introduction to Islamic Finance	19 Dec: Last day for withdrawal from all courses with "WP/WF"
15 (Dec 21-25)	Guest material	Introduction to Islamic Finance (continued 2 lect). Review	
16 (Dec 28)		Exam preparation	
Final Exam: 8:00am Jan 6, 2015			