King Fahd University of petroleum & minerals

College of Computing & Mathematics

DEPARTMENT OF MATHEMATICS

Course information

AS201: Financial Mathematics	**Semester**: 241
Credit hours: 3-0-3	**Meeting days and time :** UTR: 8:00-8:50 AM
Classroom location: B24-Room125	**Course Website or URL:** https://blackboard.kfupm.edu.sa/webapps/blackboard/content/listContentEditable.jsp?content_id=_2438009_1&course_id=_99352_1#

Instructor information

Instructor (e-mail)	Preferred Contact method	**Location**	**Office Hours** Day: time
Esam Al-Sawi (alsawies)	MS teams	**B5-R310**	UTR: 9:05-9:50 & 12:05-12:40 MW: by appointment

Course description:

Theory of compound interest and the mathematics of investment and credit. Measurement of interest, annuities certain (level, non-level, and continuous), amortization schedules, sinking funds, investment yield rates, and valuation of bonds and other securities. Methods of loan measurement and payments (Islamic and Conventional) are illustrated in amortization and sinking fund schedules. Islamic views on interest and investments.

Course Objective:

The course develops the candidate's understanding of the fundamental concepts of financial mathematics.

Learning Outcomes:

Course Learning Outcomes (CLOs) and the Assessment Methods		
	CLOs	**Assessment Methods**
1	**Knowledge and Understanding**	
1.1	Define and recognize the definitions of the following terms: interest rate (rate of interest), simple interest, compound interest, accumulation function, future value, current value, present value, net present value, discount factor, discount rate (rate of discount), convertible m-thly, nominal rate, effective rate, inflation and real rate of interest, force of interest, equation of value.	Classwork Activities + Major Exam 1+ Final Exam
1.2	Define and recognize the definitions of the following terms: principal, interest, term of loan, outstanding balance, final payment (drop payment, balloon payment), amortization.	Classwork Activities + Major Exam 2+ Final Exam
1.3	Define and recognize the definitions of the following terms: cash flow matching, immunization (including full immunization), Redington immunization.	Classwork Activities + Final Exam
2	**Skills**	
2.1	Given any one of the effective interest rate, the nominal interest rate convertible m-thly, the effective discount rate, the nominal discount rate convertible m-thly, or the force of interest, calculate any of the other items.	Classwork Activities + Major Exam 1+ Final Exam
2.2	Calculate: • The missing item, given any four of: term of loan, interest rate, payment amount, payment period, principal. • The outstanding balance at any point in time. • The amount of interest and principal repayment in a given payment. • Similar calculations to the above when refinancing is involved.	Classwork Activities + Major Exam 2+ Final Exam
2.3	Calculate the market value, notional amount, spot rates or swap rate of an interest rate swap, deferred or otherwise, with either constant or varying notional amount.	Classwork Activities + Final Exam
2.4	Construct an investment portfolio to: • Redington immunize a set of liability cash flows. • Fully immunize a set of liability cash flows. • Exactly match a set of liability cash flows.	Classwork Activities + Final Exam

Instructional Methods

Students will experience different teaching strategies as follow (brief description is provided):

- **Interactive Lectures**:

Students will participate through questions, discussions, and group activities. (material will be shared)

- **Flipped Classroom Approach**:

Students review materials before class and will be engaged in active learning activities during lectures.

- **Think-Pair-Share**:

Students share and compare possible answers to a question with a partner before addressing the larger class.

- **Student Learning Communities**:

Focus on sharing and joint discovery.

- **Group Instructional Feedback Technique:**

What works, what doesn't, and how to fix it, then reports them to the instructor.

COURSE MATERIALS

Textbook:

Broverman, S.A., Mathematics of Investment and Credit (Fifth Edition), 2010, ACTEX Publications, ISBN 978-1-56698-767-7.

Additional References

Daniel, J.W., and Vaaler, L.J.F., Mathematical Interest Theory (Second Edition), 2009, The Mathematical Association of America, ISBN: 978-0883857540. 6.

Prerequisite

MATH102

Assessment:

Activity	Weight
Class Work : It is based on class activities determined by the instructor, quizzes, class tests, HW or other.	20%
Exam 1 (chapters 1 & 2) : (TBA)	22%
Exam 2 (chapters 3,4 &5): (TBA)	23%
Final Exam (Registrar Website) (Comprehensive)	35%
Total	100%

Important notes

- Students are advised to check Blackboard regularly for regular announcements.
- Students are required to carry pens, note-taking equipment and a calculator to EVERY lecture, quizzes, and exams. It is strongly recommended to keep a binder for class-notes.
- 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.
- Homework problems solutions should be complete with **justifications and reasons** for all steps by referencing theorems, equations and discussion from your textbook.
- **Copying** from any source, human, print or electronic will result in a zero on the homework and will be reported to the department chairman for appropriate action in accordance with University rules.

Exam Issues:

- No student will be allowed to take the exam if he/she does not bring his/her KFUPM ID, or National/Iqama ID, or Driver's License with him/her to the exam hall.
- Students are not allowed to have their mobiles, smart watches, or any electronic device in the exam hall. A violation of this will be considered an attempt of cheating.

Missing an Exam:

In case a student misses an exam (Exam I, Exam II, or the Final Exam) for a legitimate reason (such as medical emergencies), she/he must bring an official excuse from Students Affairs. Otherwise, she/he will get zero in the missed exam.

The Usage of Mobiles in Class:

Students are not allowed to use mobiles for any purpose during class time. Students who want to use electronic devices to take notes must take permission from their instructor. Violations of these rules will result in a penalty decided by the instructor.

Academic Integrity:

All KFUPM policies regarding ethics and academic honesty apply to this course.

Syllabus

Week	Section	Material	Problems	Teaching Method & Activities
1		**CH1: Interest rate Measurement**		Self study through material
	1.1	Interest Accumulation and Effective Rates of	5, 7, 9, 10	Preparing answers for worksheet and Group discussion
	1.2	Interest Present Value (excluding 1.2.1)	5, 8, 11, 12	
2	1.3	Equation of Value	17, 18	Lectures, Presenting Examples. Class worksheets and Group discussion
	1.4	Nominal rates of Interest	3, 5, 7, 8	
	1.5	Effective and Nominal Rates of Discount	4, 8, 9, 11	
3	1.6	The force of Interest	2, 4, 6, 9, 11	Lectures, Presenting Examples. Class worksheets and Group discussion
	1.7	Inflation and the "Real" rate of Interest	1, 2, 3, 4, 7	
4		**Ch2: Valuation of Annuities**		Lectures, Presenting Examples. Class worksheets and Group discussion
	2.1	Level Payment Annuities	1, 7, 11, 12, 16, 19	
	2.2	Level payment Annuities – Some Generalizations	1, 3, 4, 5, 9, 13	
5	2.3	Annuities with Non-Constant payment	2, 3, 4, 5, 8, 10, 11,	Lectures, Presenting Examples. Class worksheets and Group discussion
	2.4	Applications & Illustrations (excluding 2.4.2 &2.4.3)	14, 17, 18 3,6, 7 ,9 ,11	
6		**Ch3: Loan Repayment**		Lectures, Presenting Examples. Class worksheets and Group discussion
	3.1	The amortization model of Loan Repayment	1, 2, 4, 5, 7, 9	
	3.2	Amortization of a Loan with Level Payments (excluding 3.2.1 & 3.2.2)	3, 4, 6, 7, 8, 11, 26	
7	3.3	The sinking Fund Method of Loan Repayment	3, 4, 6, 7	Lectures, Presenting Examples. Class worksheets and Group discussion
		Ch4: Bond Valuation		
	4.1	Determination of Bond Prices	1, 3, 4	
8	4.2	Amortization of a Bond	3, 4, 5, 7	Lectures, Presenting Examples. Class worksheets and Group discussion
	4.3	Applications and Illustrations (excluding 4.3.2)	2, 4, 5, 9, 10, 14, 21	
9		**Ch5: Measuring the Rate of Return of an Investment**		Lectures, Presenting Examples. Class worksheets and Group discussion
	5.1	Internal Rate of Return defined and Net Present Value (excluding 5.1.4)	2, 3, 5, 6/a, 7, 10	
10	5.2	Dollar-weighted and Time-Weighted Rate of return	1, 3, 4, 5, 6	Lectures, Presenting Examples. Class worksheets and Group discussion
	5.3	Applications and Illustrations (excluding the investment year portion of 5.3.1, 5.3.2 & 5.3.3)	1, 2, 3	
11		**Ch6: The term structure of interest rates**		Lectures, Presenting Examples. Class worksheets and Group discussion
	6.1	Spot Rates of Interest	1, 2, 3(a-i,b-i,c-i), 5	
	6.3	Forward rates of Interest	4, 5	
12		**Ch7: Cash flow duration and Immunization**		Lectures, Presenting Examples. Class worksheets and Group discussion
	7.1	Duration of a set of Cash flows and Bond duration (excluding 7.1.6)		
13	7.2	Asset-liability Matching and Immunization		Lectures, Presenting Examples. Class worksheets and Group discussion
		Ch8: Additional Topics in Finance and Investment.		
	8.1	The dividend discount model of stock valuation		
14	SOA Exam FM Note	Using Duration and Convexity to approximate change in present value.		Class worksheets and Group discussion
15-16		Review \ Exam FM Practice Problems		