**Financial Mathematics**
**Spring 2010**
**MATH 472.01 (3 credits), Tu_Th, 1:00P-2:15P, Wickersham 218**

**Prerequisites:** A grade of C- or better in MATH 311 *Calculus III* is the prerequisite for this course.[1]

**Instructor:** Dr. Buchanan
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Office Hours: 3:00PM-4:00PM (M & F), 2:30PM-3:30PM (Tu & Th) or by appointment
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**Textbook:** J. Robert Buchanan, *An Undergraduate Introduction to Financial Mathematics*, 2nd edition, World Scientific Publishing Company, Hackensack, NJ USA (2008), ISBN: 978-981-283-535-2.

**Objectives:** The objectives of this course include introducing the students to the mathematical treatment of risk-neutral valuation, arbitrage, options, futures, and derivatives. One of the main mathematical results to be covered is the derivation, understanding, and use of the Black-Scholes formula for pricing options. A comparison of the assumptions underlying this pricing model and actual financial markets will be made to understand the utility and limitations of the Black-Scholes formula.

**Course Contents:** The semester activities may include exposure to and exploration of the following topics.

Partial Topic List:

- Elementary probability: probabilities and events, conditional probability, random variables, expected values, covariance, and correlation.
- Normal random variables: continuous random variables, properties of normal random variables, the Central Limit Theorem.
- Brownian motion: geometric Brownian motion and its development as a limit of simpler models.
- Review of interest rates and present value analysis: rates of return and continuously varying interest rates.
- Fixed-income securities: value formulas, bond details, yield, duration.
- Term structure of interest rates: yield curve, forward rates, floating rate bonds.
- Capital asset pricing model: market equilibrium, capital market line, security market line, investment implications.

[1]Previously *Calculus III* was numbered as MATH 261.

- Examples pricing contracts via arbitrage.
- General principles: utility functions, risk aversion, linear pricing, portfolio choice, finite models, risk-neutral pricing.
- The Arbitrage Theorem: the Fundamental Theorem of Financial Mathematics and multi-period binomial models.
- Elementary ordinary and partial differential equations, boundary and initial value problems, Fourier transforms.
- The Black-Scholes formula: properties of Black-Scholes option cost, estimating the volatility parameter, and pricing Put Options.
- Valuing by expected utility: limitations of arbitrage pricing, portfolio selections, estimating covariances, mean variance analysis of risk-neutral-priced Call Options, and single period rates of return.
- Interest rate derivatives: examples, theory, and pricing applications,

**Attendance:** Students are expected to attend all class meetings, but mere attendance will not prepare you for the assignments and assessments. If you must be absent from class on the day an assignment is due, you must complete and hand in the assignment prior to the absence. If you know you will be absent on the day of a test, you must notify me before the time the test is scheduled in order to schedule a make-up test. Students who miss a test should provide a valid excuse, otherwise you will not be allowed to make up the test. Tests should be made up within one week of their scheduled date. No final exam exemptions.

**Homework:** Students are expected to do their homework and participate in class. Students should expect to spend a minimum of three hours outside of class on homework and review for every hour spent in class. Occasionally specific homework problems will be assigned for collection and grading. Students should submit all homework by the date due. Late homework will not be accepted without valid excuse. Discussion between students on homework assignments is encouraged, but homework submitted for grading should be written up separately.

Each student is expected to complete a course project on a topic assigned by the instructor. The project will include a written component and an in-class oral presentation of 10 minutes duration.

**Tests:** There will be a two in-class tests and a comprehensive final examination. The dates for these assessments are sets as follows.

- Test 1, Tuesday, February 23, 2010
- Test 2, Tuesday, April 6, 2010
- Final Examination, May 4, 2010, 10:15AM-12:15PM

I will not "curve" test or exam grades.

**Grades:** Course grade will be calculated as follows.

| | |
|---|---|
| Tests | 40% |
| Final exam | 20% |
| Homework | 30% |
| Project | 10% |

I keep a record of students' homework and test scores. Students should also keep an individual record of graded assignments. I will not "curve" course grades. The course letter grades will be calculated as follows.

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|---|---|---|---|---|---|
| 90-92 | A− | 93-100 | A | | |
| 80-82 | B− | 83-86 | B | 87-89 | B+ |
| 70-72 | C− | 73-76 | C | 77-79 | C+ |
| 60-62 | D− | 63-66 | D | 67-69 | D+ |
| | | 0-59 | F | | |

**Course Repeat Policy** An undergraduate student may not take an undergraduate course of record more than three times. A course of record is defined as a course in which a student receives a grade of A, B, C, D, (including + and −) F, U, Z or W. The academic department offering a course may drop a student from a course if the student attempts to take a course more than three times.[2]

The last day to withdraw from a course (and receive the W grade) is April 2, 2010.

**Inclement Weather Policy:** If we should miss a class day due to a school closing because of weather, any activities planned for that missed day will take place the next time the class meets. For example, if a test is scheduled for a day that class is canceled on account of snow, the test will be given the next time the class meets.

**Final Word:** Math is not a spectator sport. What you learn from this course and your final grade depend mainly on the amount of work you put forth. Daily contact with the material through homework assignments and review of notes taken during lectures is extremely important.

[2]Memorandum to mathematics faculty from Dr. Charles G. Denlinger, Assistant Chair, Department of Mathematics, August 30, 2004.