**NEW YORK CITY COLLEGE OF TECHNOLOGY**

**The City University of New York**

**DEPARTMENT**: Mathematics

**COURSE**: MAT 3788

**TITLE**: Applications of the Heat Equation for Financial Mathematics

**DESCRIPTION:** Focuses on the Black-Scholes Model. Includes risk measures in a portfolio of financial assets: The Greek Letters and Value at Risk. Computer models will be used.

**TEXT**: Options, Futures and Other Derivatives

John C. Hull

Pearson, 10th edition

**CREDITS**: 3 (3 class-hours)

**PREREQUISITES:**  MAT 2630, MAT 2572, MAT 2675, CST 3503

Prepared by Professor Nadia Benakli (2011), Revised by Professor Satyanand Singh (Fall 2019)

A. Testing/Assessment Guidelines:

The following exams should be scheduled:

1. A one session exam at the end of the First Quarter.

2. A one session exam at the end of the Second Quarter.

3. A one session exam at the end of the Third Quarter.

4. A one session Final Examination.

**Course Intended Learning Outcomes/Assessment Methods**

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| **Learning Outcomes** | **Assessment Methods** |
| **1.** Perform an analysis of financial derivatives and risk management. | Classroom activities and discussion, homework, exams. |
| **2.** Apply the Binomial Tree Model to evaluate the price of an option. | Classroom activities and discussion, homework, exams. |
| **3.** Use the Black-Scholes Formulas to evaluate the price of an option and the Greek letters. | Classroom activities and discussion, homework, exams. |
| **4.** Translate ideas into mathematical statements and check their validity in a computational environment. | Classroom activities and discussion, homework, exams. |
| **5.** Use the terminology of the financial industry. | Classroom activities and discussion, homework, exams. |
| **6.** Be prepared to take a graduate course in Mathematical Finance. | Classroom activities and discussion, homework, exams. |

**General Education Learning Outcomes/Assessment Methods**

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| **Learning Outcomes** | **Assessment Methods** |
| **1.** Gather, interpret, evaluate, and apply information discerningly from a variety of sources. | Classroom activities and discussion, homework, exams. |
| **2.** Understand and employ both quantitative and  qualitative analysis to solve problems. | Classroom activities and discussion, homework, exams. |
| **3.** Employ scientific reasoning and logical thinking. | Classroom activities and discussion, homework, exams. |
| **4.** Communicate effectively using written and oral means. | Classroom activities and discussion, homework, exams. |
| **5.** Utilize computer based technology in accessing information, solving problems and communicating. | Classroom activities and discussion, homework, exams. |
| **6.** Work with teams. Build consensus and use creativity. | Classroom activities and discussion. |
| **7.** Acquire tools for lifelong learning. | Classroom activities and discussion, homework, exams. |

**New York City College of Technology Policy on Academic Integrity**

Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion. The complete text of the College policy on Academic Integrity may be found in the catalog.

**MAT 3788** Applications of the Heat Equation for Financial Mathematics **Text:** Options, Futures and Other Derivatives by Hull, 10th ed.

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| Session | **Applications of the Heat Equation for Financial Mathematics** | **Homework** |
| 1-3 | Chapter 1 Introduction | **P. 19**: 1.1–1.19, 1.20-1.28 |
| 4-7 | **Chapter 2** Future Markets and Central Counterparties  **Chapter 5** Determination of Forward and Future Prices | **P. 45**: 2.1-2.4, 2.8, 2.11, 2.12, 2.17, 2.19, 2.21, 2.22  **P. 131**: 5.1-5.5, 5.9-5.12, 5.21-5.25 |
| 8 | **First Examination** |  |
| 9-13 | **Chapter 10** Mechanics of Option Markets  **Chapter 11** Properties of Stock Options  **Chapter 13** Binomial Trees | **P. 227**: 10.1-10.4, 10.9-10.10, 10.12-10.17, 10.22  **P. 248**: 11.1-11.17  **P. 293**: 13.1-13.14, 13.16-13.18 |
| 14 | **Second Examination** |  |
| 15-20 | Chapter 14 Wiener Processes and Ito’s LemmaChapter 15 The Black-Scholes-Merton Model | **P. 314**: 14.1-14.7  **P. 346**: 15.1, 15.3-15.16, 15.22, 15.23 |
| 21-23 | Chapter 19 The Greek Letters | **P. 425:** 19.2-19.5, 19.8, 19.10, 19.14, 19.22, 19.23 |
| 24 | Third Examination |  |
| 25-28 | Chapter 22 Value at Risk | **P. 455:** 22.1, 22.3, 22.5, 22.8, 22.9 |
| 29 | Project Presentation |  |
| 30 | Final Examination |  |

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| **Applications of the Heat Equation for Financial Mathematics** | Homework |
| **Chapter 1** Introduction | P. 19: 1.1–1.19, 1.20-1.28 |
| **Chapter 2** Future Markets and Central Counterparties | **P. 45**: 2.1-2.4, 2.8, 2.11, 2.12, 2.17, 2.19, 2.21, 2.22 |
| **Chapter 5** Determination of Forward and Future Prices | P. 131: 5.1-5.5, 5.9-5.12, 5.21-5.25 |
| **Chapter 10** Mechanics of Option Markets | **P. 227**: 10.1-10.4, 10.9-10.10, 10.12-10.17, 10.22 |
| **Chapter 11** Properties of Stock Options | **P. 248:** 11.1-11.17 |
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