

## MATH 632 - Mathematical Finance in Industry

MW 6:40 - 8:00 PM, Room: HILL 705

[Course website](#)

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**Instructor:** Triet Pham, Office: Hill 508, Email: [tmp140@math.rutgers.edu](mailto:tmp140@math.rutgers.edu)

**Office Hours:** MTh 3:00 - 5:00 pm and by appointment.

**TA: Yujia Fan** Email: [yf198@scarletmail.rutgers.edu](mailto:yf198@scarletmail.rutgers.edu)

### Textbook:

1. John Hull : Options, Futures and Other Derivatives, 10th edition
2. John Hull : Risk Management and Financial Institutions (Wiley finance), 5th edition

### Reference:

1. P. Wilmott. Frequently asked questions in quantitative finance. John Wiley & Sons, 2010.
2. M.S. Joshi, N. Denson and A. Downes. Quant Job Interview: Questions and Answers. CreateSpace, 2008
3. Kuznetsov. The complete guide to capital markets for Quantitative Professionals. McGraw Hill Professional, 2007.

**Course Objectives:** The goal of the course is to introduce the students to an overall picture of the financial markets, their main features, products and operations. Risk and risk management will also be a main component in the course. The connection between quantitative methods and models to their actual usage in the financial world will be emphasized. The course will cover most of the material in "Options, Futures and other Derivatives" by John Hull (Pearson, 2015) and "Risk Management and Financial Institutions" by John Hull (Wiley, 2015)

### Course Outline:

Please note that this is a tentative outline. As the course progresses, we may adjust the pace and / or the material if necessary. It may be that we do not cover the last few topics. There will also be additional notes posted on the course website.

Week 1: Introduction to the financial market: financial institutions and their trading, insurance companies and pension plans, mutual funds and hedge funds, trading in financial markets

Week 2: Futures: mechanics of future markets, hedging strategies using futures, determination of forward and future prices

Week 3: Options I: mechanics of option markets, properties of stock options, trading strategies involving options. option pricing and modeling

Week 4: Options II: Options on stock indices and currencies, futures options, exotic options

Week 5: Interest rates: type of rates, measuring interest rates, interest rate models, forward rates, bond pricing, duration, convexity, interest rate futures

Week 6: Fixed income derivatives: options on bonds, bond forwards and futures, caplets, floorlets, swaps, swaptions

Week 7: Valuation and scenario analysis: the risk neutral and real worlds, risk neutral evaluation, scenario analysis, when both worlds have to be used, the calculations in practice, martingales and measures, numeraire and change of numeraire

Week 8: Hedging and volatility: The Greeks, Implied volatility and the volatility surface, pricing derivatives using the volatility surface, the realities of hedging, hedging exotic options

Week 9: VaR and volatility: definition of VaR, VaR and capital, coherent risk measures, implied volatility, historical volatility, ARCH, GARCH

Week 10: Credit risk: credit ratings, credit risk in derivative transactions, default correlation, credit VaR, credit derivatives: CDS and CDO

Week 11: Historical simulation, model building approach, model building vs historical simulation

Week 12: Scenario analysis and stress testing, operational risk, liquidity risk, model risk

Week 13: Risk management: managing credit risk, margin, OTC markets, estimating default probabilities, CVA and DVA, enterprise risk management

Week 14: The financial crisis of 2007-2008 (and other crises): the role of structured credit and risk managements, contagions, roles of incentives and importance of transparency, lessons learned, regulations before and after the crisis

### **Grade Breakdown:**

Homework: 20 %

Quiz / Attendance : 10 %

In class presentation : 20 %

Midterm : 15 %

Final report and presentation : 15 %

Final exam : 20 %

**Academic Honesty:** As a Rutgers University student, you have agreed to abide by the University's academic honesty policy, as stated in <http://academicintegrity.rutgers.edu>. Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation. Questions related to course assignments and the academic honesty policy should be directed to the instructor.

**Extra help:** All students are strongly encouraged to come to my office hours to discuss homework problems or any aspect of the course. I am also available by appointments if the office hours do not

fit into your schedule. Sending me emails regarding your questions is also an excellent way to get a prompt response.

**University Attendance Policy:** Students are expected to attend classes regularly, according to what is stated in <http://sasundergrad.rutgers.edu/academics/courses/registration-and-course-policies/attendance-and-cancellation-of-class>

## Important Dates:

Midterm ..... Oct 31, 2018

Final Exam ..... Monday December 17, 8pm - 11pm

You can also check the final exam schedule [here](#)

## Student-Wellness Services:

Just In Case Web App

<http://codu.co/cee05e>

Access helpful mental health information and resources for yourself or a friend in a mental health crisis on your smartphone or tablet and easily contact CAPS or RUPD.

## Counseling, ADAP & Psychiatric Services (CAPS)

(848) 932-7884 / 17 Senior Street, New Brunswick, NJ 08901 / [www.rhscaps.rutgers.edu/](http://www.rhscaps.rutgers.edu/)

CAPS is a University mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professional within Rutgers Health services to support students efforts to succeed at Rutgers University. CAPS offers a variety of services that include: individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

## Violence Prevention & Victim Assistance (VPVA)

(848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901 / [www.vpva.rutgers.edu/](http://www.vpva.rutgers.edu/)

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

## Disability Services

(848) 445-6800 / Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854 / <https://ods.rutgers.edu/>

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation:

<https://ods.rutgers.edu/students/documentation-guidelines>.

If the documentation supports your request for reasonable accommodations, your campus disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: <https://ods.rutgers.edu/students/registration-form>.

## Scarlet Listeners

(732) 247-5555 / <http://www.scarletlisteners.com/>

Free and confidential peer counseling and referral hotline, providing a comforting and supportive safe space.