UNIVERSITY OF OKLAHOMA
DSA 5303: FINANCIAL ENGINEERING ANALYTICS
SUMMER 2025
Online Course – 3 credit hours

Instructor: Dr. Theodore Trafalis
Email: ttrafalis@ou.edu
Office Phone: (405) 325-3721
Office Hours: via Zoom every Wednesday from 11:00am-12:00 pm CST and by appointment

Teaching Assistant: Scott Seidenberger
Email: seidenberger@ou.edu
Office Hours: via Zoom by appointment, please email to setup

Zoom Link
Topic: DSA5303 Office Hours
Time: Every Wednesday from 11:00 AM – 12:00 PM Central Time (US and Canada)

Join Zoom Meeting
https://oklahoma.zoom.us/j/99706051911?pwd=OwSgahfhTZ3fgaLDWzUIWG6VCD1Ikw.1

Meeting ID: 997 0605 1911
Passcode: 34053594

LEARNING MANAGEMENT SYSTEM
https://canvas.ou.edu

COURSE MEETING TIME & LOCATION
Fully online. See the course schedule.

PREREQUISITES
There are no prerequisites for this course. However, a solid foundation in Microsoft Excel, Statistics, Differential Equations, R and Linear Algebra will be helpful but not necessary. You will have access to resources in Canvas that will refresh your knowledge in these areas.

COURSE DESCRIPTION
Financial Engineering is a multidisciplinary field involving the fields of finance, economics, mathematics, statistics, engineering, and computer science. The main focus of the course will be on the (i) use of optimization and stochastic models to solve portfolio optimization problems (ii) price derivative securities including energy and weather derivatives and (iii) consider applications of financial engineering including algorithmic trading, financial networks, pricing of real options and the use of machine learning in pricing. Data-driven models and big data mining in financial engineering will also be discussed.

COURSE GOALS & LEARNING OBJECTIVES

By the end of this course, you will be able to:

• To gain an understanding and appreciation of the principles and methodologies relevant to financial engineering and financial data analysis

• To solve real-life problems with financial engineering techniques.

• To build a solid theoretical background in financial engineering and investigate the recent topics for future research and study such as machine learning and data mining.

REQUIRED TEXTBOOK

- Investment Science 2nd Edition**,** David G. Luenberger Oxford University Press, 2013
- Options, Futures and Other Derivatives 9th Edition by John C. Hull, Pearson, 2014

ADDITIONAL RESOURCES:

• A Primer for Financial Engineering: Financial Signal Processing and Electronic Trading, 1st Edition by Ali N. Akansu and Mustafa U. Torun, 2015

• Clewlow, L., Strickland, C.: Energy Derivatives: Pricing and Risk Management. Lacima Publ., London (2000)

• Financial Signal Processing and Machine Learning, Editor(s): Ali N. Akansu, Sanjeev R. Kulkarni, Dmitry Malioutov, Wiley, 2016

• Cristianini, N., Shawe-Taylor, J.: An Introduction to Support Vector Machines and Other

• Kernel-Based Learning Methods. Cambridge University Press, Cambridge (2000)

• Machine Learning for Asset Managers, Marcos M. López de Prado, Cambridge University Press, 2020

• Advances in Financial Machine Learning 1st Edition by Marcos Lopez de Prado, Wiley, 2018

• Financial Analytics with R: Building a Laptop Laboratory for Data Science, Mark J. Bennett , Dirk L. Hugen, Cambridge University Press, 2016

Additional readings: Some chapters from textbooks and some research papers are useful for this course. When available in electronic form, they will be placed in the homepage of the course in portable document format (.pdf).

TOPICS COVERED:

The topics in this course will cover:

• Introduction to Mean Variance-Portfolio Theory

• Capital Asset Pricing Model (CAPM)

• Utility and Risk Aversion

• Factor Models

• Data and Statistics

• Derivatives: An Overview

• Options Markets

• Data Driven Models and Machine Learning in Financial Engineering

• Applications

• The risk in Financial Engineering

COURSE FORMAT

The course is delivered in an online format, consisting of lecture videos, lecture slides, readings, assignments, concept checks, discussions, and a project.

UNIT CONCEPT CHECKS

Students are responsible for all of the material covered from the readings, lectures, exercises, and any other assigned materials. Each unit features a concept check. These checks provide you with feedback on your basic understanding of key points and help you prepare for the unit assignment. All concepts will be related to course goals and unit objectives.

ASSIGNMENTS

Students will be responsible for:

- Solving various problems throughout the semester (8 total)
- An oral presentation
- Submitting a project (See project guidelines on page 4)

EVALUATION

There are no exams. Grades will be determined by students' solution to problems distributed during the semester. In addition, each student will be required to make an oral presentation and submit a project.

Assignments (8 total): 30%
Oral Presentation: 20%
Project: 50%
Total: 100%
Grading Scheme: 90-100% (A), 80-89% (B), 70-79% (C), 60-69% (D), and < 60% (F).

LATE POLICY

Although the Canvas platform will accept late submissions (marked in red), **you will be given 0 points for late work**. However, assignments may be turned in early.

COURSE POLICY ON ACADEMIC INTEGRITY

Cheating is strictly prohibited at the University of Oklahoma. As a member of the OU community, it is your responsibility to protect your educational investment by knowing and following the rules. Should you see someone else engaging in this behavior, I encourage you to report it to myself or directly to the Office of Academic Integrity Programs. That student is devaluing not only their degree but yours, too. Be aware that it is my professional obligation to report academic misconduct, which I will not hesitate to do. Sanctions for academic misconduct can include expulsion from the University and an F in this course, so don't cheat. It's simply not worth it. For specific definitions on what constitutes cheating, review the Student's Guide to Academic Integrity at http://integrity.ou.edu/students_guide.html.

REASONABLE ACCOMMODATION POLICY

Students requiring academic accommodation should contact the Disability Resource Center for assistance at (405) 325-3852 or TDD: (405) 325-4173. For more information, please see the Disability Resource Center website http://www.ou.edu/drc/home.html Any student in this course

who has a disability that may prevent him or her from fully demonstrating his or her abilities should contact me personally as soon as possible so we can discuss accommodations necessary to ensure full participation and facilitate your educational opportunities.

RELIGIOUS OBSERVANCE

It is the policy of the University to excuse the absences of students that result from religious observances and to reschedule examinations and additional required classwork that may fall on religious holidays, without penalty.

TITLE IX RESOURCES AND REPORTING REQUIREMENT

For concerns regarding gender-based discrimination, sexual harassment, sexual misconduct, stalking, or intimate partner violence, the University offers a variety of resources, including advocates on call 24/7. To learn more or to report an incident, please contact the Sexual Misconduct Office at 405-325-2215 (8 to 5, M-F) or OU Advocates at 405-615-0013 (24/7). For more information, please see http://www.ou.edu/eoo.

ADJUSTMENTS FOR PREGNANCY/CHILDBIRTH RELATED ISSUES

Should you need adjustments to your course requirements because of documented pregnancy related or childbirth-related issues, please contact me or the Disability Resource Center at 405/325-3852 as soon as possible. http://www.ou.edu/eoo/faqs/pregnancy-faqs.html

Final Exam Preparation Period

The pre-finals week will be defined as the seven calendar days before the first day of finals. Faculty may cover new course material throughout this week. For specific provisions of the policy, please refer to OU's Final Exam Preparation Period policy. (https://apps.hr.ou.edu/FacultyHandbook#4.10)

Emergency Protocol

During an emergency, there are official university procedures that will maximize your safety.
Severe Weather: If you receive an OU Alert to seek refuge or hear a tornado siren that signals severe weather *1. LOOK* for severe weather refuge location maps located inside most OU buildings near the entrances *2. SEEK* refuge inside a building. Do not leave one building to seek shelter in another building that you deem safer. If outside, get into the nearest building. *3. GO* to the building's severe weather refuge location. If you do not know where that is, go to the lowest level possible and seek refuge in an innermost room. Avoid outside doors and windows. *4.* GET IN, GET DOWN, COVER UP. 5. *WAIT* for official notice to resume normal activities.
Link to Severe Weather Refuge Areas, Severe Weather Preparedness - Video

Armed Subject/Campus Intruder

If you receive an OU Alert to shelter-in-place due to an active shooter or armed intruder situation or you hear what you perceive to be gunshots:
1. GET OUT: If you believe you can get out of the area WITHOUT encountering the armed individual, move quickly towards the nearest building exit, move away from the building, and call 911. *2. HIDE OUT*: If you cannot flee, move to an area that can be locked or barricaded, turn off lights, silence devices, spread out, and formulate a plan of attack if the shooter enters the room. *3. TAKE OUT*: As a last resort fight to defend yourself.

For more information, visit http://www.ou.edu/emergencypreparedness.html
Shots Fired on Campus Procedure - Video

Fire Alarm/General Emergency
If you receive an OU Alert that there is danger inside or near the building, or the fire alarm inside the building activates: *1. LEAVE* the building. Do not use the elevators. *2. KNOW* at least two building exits *3. ASSIST* those that may need help *4. PROCEED* to the emergency assembly area *5. ONCE safely outside, NOTIFY first responders of anyone that may still be inside building due to mobility issues. 6. WAIT* for official notice before attempting to re-enter the building.
OU Fire Safety on Campus

Students are responsible for any changes/additions to this syllabus announced in class.

Project and Presentation Guidelines

1. The project is to be done individually.

2. Each student should select a project falling in at least one of the following categories:
(i) A direct application of a financial engineering model from a text or journal by collecting data and solving it using the computer.
(ii) Improving and extending the results of a given study for a more realistic solution. Here, you may use the same data available in the study and compare your results to the existing one.
(iii) Developing a new and different financial engineering model for a real problem and present solution approach. Here, you may just use fictitious data to illustrate your methodology.
(iv) Developing or improving a computer program for a financial engineering model.
(v) Experiments with different financial engineering models on problems.

3. Preliminary Report - A two to three-page statement explaining the project.
NOTE: Before submitting the report, you may discuss the project informally with me to ascertain whether your project will meet the desired objectives and standards.

4. Final Report: To be limited to 10 pages (excluding computer printout and appendices). Your final report should discuss the model formulation and solution, highlighting the major contribution made by you through the project work, and difficulties encountered, deviation from the preliminary objectives, and significant conclusions.

5. Final Report: Oral Presentation
Prior to filming your Oral Presentation, please review and understand the guidelines below.
1. Your video is to be 15-20 minutes.
2. You need to present the methodology and findings of the project.
3. Once you have recorded your video, you will need to upload it to a video-sharing website (YouTube, MyMedia, Vimeo, etc.) in order to obtain a link. This is to minimize long upload times in the Canvas platform due to large video files.
4. You will post your video link to this Discussion Assignment.

5. After you have posted your link, watch your classmates' presentations and comment. Comments should be well-organized and respectful. You are not to comment "good job". I want the comments to be used to spark discussion among the projects.

6. Please email me a copy of your PPT presentation at: ttrafalis@ou.edu and seidenberger@ou.edu
NOTE: You are welcome to discuss with me the progress of your project from time to time. The following points will be taken into consideration while awarding the project grade:
(i) Complexity of the project.
(ii) Adherence to the project guidelines.
(iii) Presentation of final report. (iv) Results and major contributions.