

### 1. Course Information:

Course : EMSE 6450.10 – Quantitative Methods in Investment Engineering  
Semester : Spring 2024 # of Credit Hours: 3.0  
Meeting Time : Wednesdays from 6:10PM to 8:40PM  
Location : Tompkins 405

### 2. Instructor and Contact Information:

Name : J. René van Dorp, Professor  
Campus Address : 800 22<sup>nd</sup> Street, Office 2800, Washington DC 20052  
Phone : 202-994-6638  
E-mail : [dorpjr@gmail.com](mailto:dorpjr@gmail.com)  
Office hours : [Mondays 1:00PM to 4:00PM](#)

### 3. Course Description:

Cash flow streams and the basic theory of interest; bond pricing and immunization of bond portfolios, the term structure of interest rates, mean-variance portfolio theory and the capital asset pricing model; value at risk. Recommended background: Technical background at the level of a bachelor's degree in engineering, mathematics, or science and working knowledge of Microsoft Excel.

### 4. Prerequisite Requirement(s) or Approval of Instructor:

**APSC 3115 (or EMSE 6115):** Engineering Analysis III (or any other undergraduate Applied Statistics course from a physical or natural sciences program).  
<http://www.seas.gwu.edu/~dorpjr/APSC3115/Intro.html>

**EMSE 4410 (or EMSE 6410):** Survey of Finance and Engineering Economics: Survey of material relevant to financial decision making for engineering activity. Includes traditional engineering economy topics; fundamentals of accounting; and financial planning, budgeting, and estimating applicable to the management of technical organizations.

### 5. Required Materials:

- a. Leunberger (2013), Investment Science, 2nd Edition, Oxford University Press.  
<http://www.amazon.com/Investment-Science-David-G-Luenberger/dp/0199740089>
- b. Electronic Lectures notes available at:  
<https://www2.seas.gwu.edu/~dorpjr/EMSE292/Coursefiles.html>
- c. MS Excel Software

## 6. Learning Outcomes

As a result of completing this course, students will be able to:

- a. Price fixed income securities such as annuities and bonds and evaluate price sensitivity of bonds as a results of market interest rate changes
- b. Construct a portfolio of bonds that is immunized against interest rate changes.
- c. Understand and apply more advanced interest rate theory to the above three topics using the term structure of interest.
- d. Perform applied interest rate analysis in a deterministic setting.
- e. Construct an efficient frontier from a series of stocks using Markowitz Portfolio Theory.
- f. Combine a Markowitz Stock Portfolio with a risk free asset to construct the capital market line and understand its connection to the Capital Asset Pricing Model
- g. Construct a Markowitz Portfolio avoiding short-selling of stocks to achieve a desired return.
- h. Articulate topics 6-8 in a investment analysis final report of 10 stocks prices of a student's choice.

## 7. Attendance

Class attendance is required. You will be held responsible for all the class discussions as well as the reading assignments. See the university policy:

<https://registrar.gwu.edu/university-policies#attendance>

## 8. Independent Learning

In a 15-week semester, including exam week, students are expected to spend a minimum of 100 minutes of out-of-class work for every 50 minutes of direct instruction, for a minimum total of 2.5 hours a week. A 3-credit course should include 2.5 hours of direct instruction and **a minimum of 5 hours of independent learning** or a total minimum of 7.5 hours per week. See the “Assignment of Credit Hour Policy” at [provost.gwu.edu/policies-procedures-and-guidelines](http://provost.gwu.edu/policies-procedures-and-guidelines) for more information.

## 9. Method of Instruction:

One hour and 20 minutes lecture including homework discussion, followed by a 10 minute break and a one hour lecture. Microsoft Excel is used to perform analysis during the class sessions and the homework. During class sessions the only software programs that should be open on your desktop are either Adobe Acrobat (for viewing the notes) or Microsoft Excel for investment analysis. **Reading assignments will have to be completed before class. Homework will have to be completed and in accordance to the outline schedule one class after it was assigned and before the class starts.** During the class sessions (except for the break of course) **a student is not to check his e-mail, the internet and should not engage in instant messaging sessions. Basically, your attention should be directed towards the class material.**

### **10. Homework Grading Policy:**

Homework sets consisting of multiple homework problems will have to be completed prior to the next class for discussion. The homework will not be graded.

### **11. Midterm Exam and Final Reports:**

Students will complete an in-class Midterm Exam using Microsoft Excel. Theoretical questions will be answered in an exam booklet. The MS EXCEL file and the exam booklet will be part of the grading of the midterm exam. The MS Excel file will need to be uploaded on Blackboard and the exam booklet handed in in-class. For the final project students will be required to download stock prices of 9 stocks and use those datasets to create an efficient frontier. Next, an investment portfolio with a desired return is to be constructed using both a risk free asset and a portfolio from this efficient frontier that avoids short selling. Student will write a final report detailing their investment analysis steps, final analysis results and investment recommendation. **Students are required to submit the electronic files associated with the final reports through blackboard** as well as **a pdf of the final report** that will be graded. **Students are required to work on their own to perform their investment analysis using their chosen stock data sets and write the final report on their own.**

### **12. Grading:**

15% - Class Attendance

40% - Midterm Exam (In-Class)

45% - Markowitz Portfolio Construction + Final Report

### **13. Homework Set and Reading Assignments:**

Homework sets, Lecture notes and recommended chapters for reading will be assigned prior to class as indicated in the outline below.



**Class Schedule: Subject to change, please check the schedule regularly**

Session	Date	Class Topic	Reading Assignments 2n Ed. (LN = Lecture Notes)	Homework Assignments
<b>DETERMINISTIC CASH FLOW STREAMS</b>				
1	1/17/2024	Cash Flow Streams and the Basic Theory of Interest	Chapters 1 - 2	Homework Set 1
2	1/24/2024	Fixed Income Securities - Part 1	Chapter 3	Homework Set 2
3	1/31/2024	Fixed Income Securities - Part 2	Chapter 3	Homework Set 3
4	2/7/2024	The Term Structure of Interest Rates	Chapter 4	Homework Set 4
5	2/14/2024	Applied Interest Rate Analysis - Part 1	Chapter 5	Homework Set 5
6	2/21/2024	Applied Interest Rate Analysis - Part 2	Chapter 5	Homework Set 6
7	2/28/2024	<b>Midterm Review</b>		
8	3/6/2024	<b>Exam 1 - Session 1 - 7</b>		
	3/13/2024	<b>SPRING BREAK</b>		
<b>SINGLE PERIOD RANDOM CASH FLOWS</b>				
9	3/20/2024	Mean-Variance Portfolio Theory - Part 1	Chapter 6, Appendix A and B	Homework Set 7
10	3/27/2024	Mean-Variance Portfolio Theory - Part 2	Chapter 6, Appendix A and B	Homework Set 8
11	4/3/2024	Mean-Variance Portfolio Theory - Part 3	Chapter 6, Appendix A and B	Homework Set 9
12	4/10/2024	FINAL PROJECT PART I - Building a Markowitz Efficient Frontier with only Risky Funds	Chapter 7	
13	4/17/2024	Data and Statistics, FINAL PROJECT PART II - Construction an investment portfolio with risky funds and a riks free asset	Chapter 9, 2nd Edition	
14	4/24/2024	Financial Risk Metrics, FINAL PROJECT PART III - Evaluating Value at Risk (VAR) and Condition VAR (CVAR) for your investment portfolio	Chapter 10, 2nd Edition	
15	5/8/2024	<b>FINAL REPORT DUE ON FINAL PROJECT</b>		

# University policies

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## Academic Integrity Code

Academic integrity is an essential part of the educational process, and all members of the GW community take these matters very seriously. As the instructor of record for this course, my role is to provide clear expectations and uphold them in all assessments. Violations of academic integrity occur when students fail to cite research sources properly, engage in unauthorized collaboration, falsify data, and otherwise violate the [Code of Academic Integrity](#). If you have any questions about whether or not particular academic practices or resources are permitted, you should ask me for clarification. If you are reported for an academic integrity violation, you should contact Student Rights and Responsibilities (SRR) to learn more about your rights and options in the process. Consequences can range from failure of assignment to expulsion from the University and may include a transcript notation. For more information, please refer to the SRR website at [studentconduct.gwu.edu/academic-integrity](http://studentconduct.gwu.edu/academic-integrity), email [rights@gwu.edu](mailto:rights@gwu.edu), or call 202-994-6757.

## University policy on observance of religious holidays

Students must notify faculty during the first week of the semester in which they are enrolled in the course, or as early as possible, but no later than three weeks prior to the absence, of their intention to be absent from class on their day(s) of religious observance. If the holiday falls within the first three weeks of class, the student must inform faculty in the first week of the semester. For details and policy, see “Religious Holidays” at [provost.gwu.edu/policies-procedures-and-guidelines](http://provost.gwu.edu/policies-procedures-and-guidelines).

## Use of Electronic Course Materials and Class Recordings

Students are encouraged to use electronic course materials, including recorded class sessions, for private personal use in connection with their academic program of study. Electronic course materials and recorded class sessions should not be shared or used for non-course related purposes unless express permission has been granted by the instructor. **Students who impermissibly share any electronic course materials are subject to discipline under the Student Code of Conduct.** Please contact the instructor if you have questions regarding what constitutes permissible or impermissible use of electronic course materials and/or recorded class sessions. Please contact Disability Support Services at [disabilitysupport.gwu.edu](http://disabilitysupport.gwu.edu) if you have questions or need assistance in accessing electronic course materials.

# Academic support

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## Writing Center

GW's Writing Center cultivates confident writers in the University community by facilitating collaborative, critical, and inclusive conversations at all stages of the writing process. Working alongside peer mentors, writers develop strategies to write independently in academic and public settings. Appointments can be booked online at [gwu.mywconline](http://gwu.mywconline).

## Academic Commons

Academic Commons provides tutoring and other academic support resources to students in many courses. Students can schedule virtual one-on-one appointments or attend virtual drop-in sessions. Students may schedule an appointment, review the tutoring schedule, access other academic support resources, or obtain assistance at [academiccommons.gwu.edu](http://academiccommons.gwu.edu).

## Support for students outside the classroom

### Disability Support Services (DSS) 202-994-8250

Any student who may need an accommodation based on the potential impact of a disability should contact Disability Support Services at [disabilitysupport.gwu.edu](http://disabilitysupport.gwu.edu) to establish eligibility and to coordinate reasonable accommodations.

### Counseling and Psychological Services 202-994-5300

GW's Colonial Health Center offers counseling and psychological services, supporting mental health and personal development by collaborating directly with students to overcome challenges and difficulties that may interfere with academic, emotional, and personal success. [healthcenter.gwu.edu/counseling-and-psychological-services](http://healthcenter.gwu.edu/counseling-and-psychological-services).

## Safety and Security

- Monitor [GW Alerts](#) and [Campus Advisories](#) to [Stay Informed](#) before and during an emergency event or situation
- In an emergency: call GWPD/EMeRG 202-994-6111 or 911
- For situation-specific actions: refer to GW's [Emergency Response Handbook](#) and [Emergency Operations Plan](#)
- In the event of an armed intruder: Run. Hide. Fight.