

The Wharton School
FNCE404, 399
FNCE892

Mr Krishna Ramaswamy
**Seminar In
Fin Engg**

Seminar in Financial Engineering

A 1CU CAPSTONE CLASS FOR SENIORS; A READINGS COURSE FOR MBAs & UGs
Tuesdays 3 to 5:50pm

1 Introduction

The course is open to all those with a strong interest in Quantitative Methods in Finance, who plan to pursue a career in Finance that demands a deeper understanding of institutions and the more rigorous models that they now use, and who are prepared to tackle those challenges. The class sizes of similar offerings has been small in recent years: this is rather unfortunate because I have learned over the years that the firms involved (Bank Derivatives Desks, Risk Management & Consulting firms, Hedge Funds and Other Financial Institutions) have been hiring intensely from well-trained students other disciplines such as Maths and the Sciences, and relying on them to develop the intuition and learn industry practice on the job. Students will have the opportunity to absorb these ideas and be exposed to these issues in this course.

A commitment to learning in this course requires a willingness to absorb more technical material and a level of engagement in *reading and learning outside the classroom*, made more necessary in Covidion because you cannot easily absorb that from discussions with colleagues and group-mates in your Project. It is for that reason that the lectures will run for 2h50m: your learning in the course – in keeping with its seminar designation – depends on having read the Text and assigned reading and the resulting Q&A in class.

Who Should Take This Course?

- Senior UGs, who can take it as FNCE 404 a capstone class (see below);
- Other UGs in Wharton or the College with a strong interest in Derivatives and Their Applications, who will take it as a Seminar in Financial Engg (Independent Study FNCE 399)
- To MBAs with an interest in advanced topics, as a Readings Course (Independent Study, FNCE892)

Admission to the class is by application – read through this description, and if you're interested, talk to a group of potential colleagues and submit the attached application! Submit your app as soon as you can to me at krishnaATupenn.edu; I rely on you to self-report relevant prior classes and the grades you got.

FNCE 404 Objectives

The course *FNCE404 Seminar in Financial Engineering* described here is a *1 CU capstone class* that requires students working in groups of at most four (4!) on a *complex financial structure*, to

- **Assess** the suitability, benefits and costs to each of the several and separate counterparties that will engage themselves contractual arrangements within the structure;
- **To describe the actions** to be taken by each counterparty in regards to any cashflows, collateral, foreign exchange requirements, and their economic impact on the counterparty's balance sheet/income

statements and its capital requirements as imposed by relevant regulatory agencies, both at the start and the periodic settlement dates that apply;

- **To model and value** the transaction, including all the clauses and contingencies in the structure – this implies assessing the cost of hedging of the central counterparty that we'll call the *arranger*, typically an Investment Bank.

In keeping with the spirit of the Capstone Requirement the group should make the important connexions to other functional areas of learning. I have in mind a few that would involve cross-border transactions and compliance & accounting issues, or exotic options on ESG portfolios for Pension Plan officers, and perhaps even setting up Forward Contract and Swap transactions with collateral clauses to enable portfolio managers to make asset allocation changes in diversified investment vehicles (like ETF portfolios targeting ESG goals.); Valuing Structured Notes with Option features that might be suitable in some DC Plan portfolios, and the many legal restrictions that might entail.

In earlier non-Covid years it might have been possible to execute the group project at greater depth; the capstone requirement has a stated 0.5CU requirement and I am mindful that senior UGs might not have the time to deliver all the items described above, and they may well whittle their objectives down further to make the project *both feasible and comparable to the workload of other capstone classes*. Therefore, I place a requirement for a Project Proposal to be submitted by 1 Feb 2021, after which I will meet with the group to advise them on how to proceed. The Project itself should be completed by 15 April.

While the Capstone Course students work on their project – I expect them to participate in the weekly lectures and do the readings.

Summary of Deliverables For Capstone (FNCE 404) students

Deliverables: (i) Class attendance & participation, (ii) a brief written project proposal describing the structure and the anticipated tasks due by 1Feb2021, and (iii) a Project Report and brief Presentation to be scheduled by 15Apr2021. We'll draw straws for the order of the group presentations.

FNCE399 & FNCE 892: Seminar in Financial Engg : Objectives

Others who are taking the course should view it as an *Independent Study or readings course*, covering several key topics in Financial Engineering, including

- Some foundational material developing the Fundamental Valuation Equation that is central to almost all derivatives (*Textbooks* listed below) and Monte Carlo methods; (**3 weeks**)
- Several Exotic Options that appear within complicated cross-border structures (eg Quantos, Lookback Options, Exchange Options, and so on); (3 weeks, material from Texts)
- the use of CDS's to hedge credit exposure when it's needed; (**2 weeks**, Assigned Readings)
- Controlling Transactions Costs in the process of hedging; (**1 week**, Text and Readings)
- Valuing the Call and Conversion Features in Corporate Bonds;(2 **weeks**, Assigned Readings)
- Valuing Incentive Contracts and Warrants. (**2 weeks**, Assigned Readings)
- In some weeks I hope to have assigned, pretty accessible, practitioner pre-reading – followed by a guest lecture by the practitioners involved, for 40mins or so, and then a Q&A.

In order to provide a useful treatment, I'll lecture for the first half of *each* weekly class on necessary technical material and solution procedures involving more advanced material than you may have seen in Financial Derivatives; and devote the second half of each weekly lecture to a reading or application.

Deliverables for the FNCE399 & 892

- Two mini problem sets to be worked in groups: they will involve a small amount of coding or using canned routines mostly within Excel or Crystal Ball or software of your group's choice'
- Being responsible with your group for a reading from a practitioner journal that is assigned as part of the reading; I lead the discussion in the second half of the lectures, starting about 15 Feb.
- Class Participation.

2 Prerequisites?

Students with some exposure to options, futures and swaps might have focused on the exchange-traded versions of these products and learned to value (or price) them with the help of models and monte-carlo methods. The vast majority of derivatives and financial structures that use them are done off-exchange! These structures are typically partially or only periodically collateralised or never collateralised (if the counterparty is a corporate, for example) hence involve credit risk; they might involve interest rate dependencies or reference rates, currency exposures and various optionalities, typically included to meet the client or counterparty's needs. Building a model with a price (or a spread or fee adjustment) for the contracts within such complicated structures is a interesting, challenging and non-trivial task. Every large institution (corporate of financial, buy or sell-side, insurance company, hedge fund) that is motivated to use these structures must assess the costs and benefits, and that's what a financial engineering task entails. Managing interest rate, FX, credit risk and collateral – these are the tricky pieces in every structure. To price them, and to hedge and manage a book of them – that's the challenge, and developing those skills early will take you far in your careers.

Those UGs/Grad Students in the college with a strong Maths & Comp Sci background and an interest in financial engineering are also encouraged to apply to FNCE399 or 892 – do read the Pre-requisites section NB below – this course will be a 1 CU credit to them.

If you have further Qs, please send email to krishna@upenn.edu.

3 Pre-requisites

Do read Items 1 & 2 through!

1. The two courses, *FNCE206 Fin Derivatives* and *FNCE235 Fixed Income* are essential building blocks for this capstone.
 - *If you're currently a junior* and will have taken both FNCE206 FINANCIAL DERIVATIVES OR FNCE235 FIXED INCOME before taking this capstone class, and have a keen interest in financial engineering, do fill out an application and email it to me!
 - *If you're currently a sophomore or a junior* who will have taken one of the two by 1 Sep 2020, you should consider taking the other in Fall 2020 and taking this Financial Engg capstone beginning Oct 2020. It may sound like a heavy load – it's not! – it will be skill-building, career-enhancing

and fun! If you're a sophomore and wish to consider taking this capstone in Financial Engg as a senior in the Fall of 2021, you might consider taking the FNCE206 and FNCE235 next year as a junior.

- If you're an MBA and wish to work on some of the topics outlined in the description above, please submit an application.

2. *Programming skills and an exposure to numerical methods are an important part* of the project in this course. If you have a strong interest in finance and have taken another Derivatives course elsewhere, AND a strong Maths/Comp Sci background, please fill in an application and send it to me.

4 Texts

I have a number of readings from very accessible, practitioner-oriented journals that I will distribute on Canvas. I'll rely on two Texts, and Cox & Rubinstein's Options Markets, for a fine discussion of Corporate Securities.

- Kerry Back, A Course in Derivative Securities, Springer.
- Deynne, Howison & Wilmott, The Maths of Financial Derivatives, Cambridge.

There are several good texts that can serve as alternatives that I will refer to in class.

5 Applying to take this Course

Application

Please type and attach, or print legibly before scanning and sending! Email it to me at krishna@upenn.edu with a **subject line** that says **FNCE404/399/892 APP**, delete the irrelevant ones!

Your Info, incldg email/'phone

Name Student ID CURRENTLY Soph/Junior/Declared Major?

Email Address:

Phone (Optional)

List Courses Taken in Finance Dept, with Grade if completed

List Courses Taken in Math or Stat, with the Grade if completed

Briefly indicate any work experience that's relevant, and why you want to take this course, especially as a capstone course?!