**FNCE 5894 – Capstone**

**Selected Topics in Credit Risk Management**

**Fall 2017 - DETAILED COURSE OUTLINE**

**SUBJECT TO CHANGE**

1. **Course Description**

The objective of the classroom portion of the Capstone for 2017 is the application of computing techniques to selected topics in credit risk management. In this context, three specifics areas will be explored. We begin with the analysis of credit exposure measurement and management as embodied by Potential Future Exposure (PFE), Expected Exposure (EE) and Expected Positive Exposure (EPE). From there, we proceed to the pricing of credit risk hedging as manifested in CVA, the credit valuation adjustment. Before concluding, we will review OIS discounting and wrong way risk. Time permitting, we will examine credit risk mitigation in the energy markets, specifically as it relates a) to the financing of power plants, and b) to margin support for energy hedging strategies.

Each topic will be explored via its mathematical finance underpinnings and by simulation methods that enable the robust calculation of complex credit risks. The technologies of choice will be Excel-based prototyping and conversion to Python codes for rapid calculations and modular modifications. Along the way, we will review some of the “greatest hits” of the past year, including the price of a swap, geometric Brownian motion, and the Black-Scholes formula, and introduce some other gems like the Margrabe formula.

1. **Instructor**

**Ed Hayes**

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1. **Course Delivery**

6 Wednesday evenings in September, October and November.

1. **Academic Integrity**

Students must adhere to the University of Connecticut Student Code, which can be found at: <http://www.community.uconn.edu/student_code.html>. Assignments and/or quizzes must be completed individually.

1. **Required Text**

The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3e by Jon Gregory. Wiley Finance.

1. **Supplemental Materials from the Textbook Website**

We will be focused on chapters 7 through 14.

[**http://www.cvacentral.com/books/credit-value-adjustment/spreadsheets/**](http://www.cvacentral.com/books/credit-value-adjustment/spreadsheets/)

[**http://www.cvacentral.com/books/credit-value-adjustment/appendices/**](http://www.cvacentral.com/books/credit-value-adjustment/appendices/)

1. **Additional Reading: (tentative)**
   1. “Relevance of Risk Capital and Margining for the Valuation of Power Plants - Cash Requirements for Credit Risk Mitigation”, Joachim Lang and Reinhard Madlener, FCN Working Paper No. 1/2010, E.ON Energy Research Center, FCN | Institute for Future Energy Consumer Needs and Behavior.
2. **Supplemental Texts:** These are books that provide additional in-depth coverage on the topics of interest to us. They provide more material than we need for this abbreviated course. The first covers CVA in depth, including an excellent chapter on (energy) commodity markets. The second is a new book with excellent overall coverage of the trading issues in the energy markets. I highly recommend both texts when you have the time, resources, and need for additional study in these areas. They are on reserve in the library.
   1. XVA: Credit, Funding and Capital Valuation Adjustments, by Andrew Green, Wiley Finance, 2015
   2. Counterparty Credit Risk, Collateral and Funding: With Pricing Cases For All Asset Classes, by Damiano Brigo, Massimo Morini, and Andrea Pallavicini. Wiley Finance, 2013.
   3. Valuation and Risk Management in Energy Markets, by Glen Swindle. Cambridge University Press, 2014.
3. **Supplemental Videos**

<http://www.mathworks.com/computational-finance/demos.html?sec=recorded>

* 1. MATLAB for Advanced Portfolio Construction and Stock Selection Models
  2. Calibration and Simulation of Interest Rate Models in MATLAB
  3. Credit Risk Modeling with MATLAB
  4. Energy Trading & Risk Management with MATLAB

1. **Outline**

Chapter references below refer to the required textbook.

Week 1 Interest Rate Swaps, Vasicek Model, Simulating PFE in Python

Week 2 Credit Exposure: Definitions, Examples, and Calculations – Chapters 8 and 9

Week 3 Quantifying Credit Exposure: Approximation and Monte Carlo – Chapter 10

Week 4 Default Probability and Credit Spreads – Chapter 12

Week 5 Discounting and Collateral – Chapter 13

Week 6 Credit Valuation Adjustment – Chapter 14

Week 7 Wrong Way Risk – Chapter 17 (tentative)

Time Permitting Reducing Credit Risk in Power Plant Development

**Grading**

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| Component | Issue Date | Due Date | % of Final Grade |
| * Programming Assignment 1 * Programming Assignment 2 * Final Exam (in class) | Sep 30  Oct 21 | Oct 28  Nov 28  TBD | 30%  30%  40% |