Financial Economic Theory and Engineering Exam
Fall 2009

<u>Important Exam Information:</u>

Exam Date and Time
: A read-through time will be given prior to the start of the exam–15 minutes in the morning session and 15 minutes in the afternoon session.

Exam Registration
: Candidates may register online or with an application.

Study Note Order Form
: Study notes are part of the required syllabus and are not available electronically.

Introductory Study Note
: The Introductory Study Note has a complete listing of all study notes as well as errata and other important information.

Case Study
: Update (7-17-09): A case study will not be used for the Fall 2009 session.

Formula Package
: A Formula Package will be provided with the exam. Please see the Introductory Study Note for more information.

Table
: A cumulative normal distribution table will be provided with the exam

Past Exams
: Past Exams from 2000-present are available on SOA web site.

Updates - 08.12.09
: Candidates should be sure to check the Updates page on the exam home page periodically for additional corrections or notices.

Syllabus for Financial Economic Theory and Engineering Exam:

The candidate should be very familiar with the Learning Objectives as described in the syllabus. These Learning Objectives are the first ingredient in developing the syllabus and also guide the examination committee when writing questions. The Learning Objectives set out the cognitive level needed to pass this exam. You will notice that the candidates are expected to "analyze," "explain," "calculate," "describe," "apply," etc. While studying the syllabus material, candidates may want to refer back to the Learning Objectives to remain focused on the goals of the exam.

1. **Modern Corporate Financial Theory**
   Overview: Definitions of Capital, Sources and Uses, and Optimal Structure
   a. Explain the various definitions of capital, including regulatory, rating agency and other risk-based capital requirements, the context in which they are appropriate, and how they affect decisions.

   Cost of Capital
   b. Calculate the cost of capital for a venture or a firm using the most appropriate method for given circumstances and justify the choice of method.
   c. Evaluate various profitability measures including IRR, NPV and ROE, etc.

   Economic Capital
   d. Define and compare risk metrics used to quantify economic capital and describe their limitations.
   e. Apply the concept of economic capital and describe methodologies for allocating capital within a financial organization.

   Regulatory and Rating Agency Issues
   f. Identify regulatory capital requirements and describe how they affect decisions.
   g. Explain the goals and methodologies of rating agencies and how their rating activities affect financial institutions and the choice of capital structure.

   Corporate Structure
   h. Recommend a specific legal form of organization and justify the choices.
   i. Recommend specific firm governance measures and justify the recommendation.
   j. Identify sources of agency costs and explain methods to address them.

Reading Materials:
- , *Financial Theory and Corporate Policy*, Copeland, Weston, Shastri , 4th Edition, 2005
    - Ch. 2: Investment Decisions: The Certainty Case
    - Ch. 9: Multi-period Capital Budgeting under Uncertainty: Real Options Analysis

- Ch. 15: Capital Structure and the Cost of Capital: Theory and Evidence
- Ch. 18: Acquisitions, Divestitures, Restructuring, and Corporate Governance, pp. 781-806
- Hardy, *Investment Guarantees*: *Modeling and Risk Management for Equity-Linked Life Insurance,* Ch. 9: Risk Measures (pp. 157-169 only) "

- FET-109-07: One Step in the Right Direction: The New C-3a Risk-Based Capital Component
- FET-112-07: *Risk Management,* Crouhy, Galai,Ch. 14: Capital Allocation and Performance Measurement
- FET-114-07: Capital Allocation in Financial Firms
- FET-115-08: Specialty Guide on Economic Capital, 2004 (**exclude appendices)**
- FET 139-07: VAR: Seductive but Dangerous
- FET-141-08: A Principles-Based Reserves and Capital Standard, Friedman & Mueller, *Tillinghast Emphasis* 2006
- FET-142-08: Do Life Insurer RBC Ratios Really Reflect Underlying Risk Levels? Citigroup, April 2007. (**exclude appendix)**
- FET-143-08:"Introducing Moody's New Liquidity Model for U.S. Life Insurance Companies, Moody's, June 2003.
- FET-144-08: The New Risk-Based Insurance Capital Model, by Standard & Poor's
- FET-145-08: : The Cost of Capital for Financial Firms
- FET-146-08: : Solvency Measurement for Property-Liability Risk-Based Capital Applications
- FET-162-08: *Financial Markets and Corporate Strategy*, Grinblatt & Titman, 2nd Edition, Ch. 18: How Managerial Incentives Affect Financial Decisions
- FET-164-08: *Risk Management,* Crouhy, Galai, Ch. 2: The New Regulatory and Corporate Environment
- FET-166-09: Megginson, W. L., *Corporate Finance Theory* Ch. 2: Ownership, Control, and Compensation
- FET-168-09: Report of the American Academy of Actuaries' C3 Life and Annuity Capital Work Group, September 2008, pp. 1-27.
- FET-170-09: Theory of Risk Capital in Financial Firms, by Merton & Perold

- Investor & Management Expectations of the Return on Equity Measure vs. Some Basic Truths of Financial Accounting, by Michelle D. Smith, *The Financial Reporter,* 9/03, http://www.soa.org/library/newsletters/financial-reporter/2003/september/frn0309.pdf

- Capital Allocation by Percentile Layer, by N. Bodoff
http://www.soa.org/library/monographs/other-monographs/2007/august/m-as07-1-03.pdf

2. Corporate Financial Applications

Sources of Capital

a. Describe the steps necessary to obtain funds for a given project or firm from any specified source, and be able to recommend a specific approach to raising capital in a given situation.
b. Describe the process, methods and uses of financial reinsurance (surplus relief) and recommend a structure that is appropriate for a given set of circumstances.
c. Describe the process, methods and uses of insurance securitizations and recommend a structure that is appropriate for a given set of circumstances.

Uses of Capital

d. Evaluate alternative options for utilizing capital and recommend the most appropriate use in a given situation.
e. Apply real options analysis to recommend and evaluate firm decisions on capital utilization.
f. Describe the process, methods and effects of a potential acquisition or reinsurance of a business including its effect on capital structure, return on equity, price/earnings multiples, and share price.

Optimal Capital Structure

g. Recommend an optimal capital structure and how to implement it for a given business or strategy and be able to justify the recommendation.
h. Describe how behavioral characteristics and biases of users and providers of capital affect the capital structure.
i. Apply the elements of risk assessment, reduction, and transfer to new product/project proposals based on a cost/benefit analysis.

Reading Materials:
- *Financial Theory and Corporate Policy*, 4th Edition, Copeland, Weston, Shastri,
  - Ch. 9: Multi-period Capital Budgeting under Uncertainty: Real Options Analysis
  - Ch. 15: Capital Structure and the Cost of Capital: Theory and Evidence
  - Ch. 16: Dividend Policy: Theory and Evidence
  - Ch. 18: Acquisitions, Divestitures, Restructuring, and Corporate Governance (pp. 781-806)

- *Insurance Industry Mergers & Acquisitions*, Toole and Herget,
  - Ch. 1: Introduction
  - Ch. 2: M&A Process Overview
  - Ch. 3: Finance
  - Ch. 4: Valuation Techniques

- FET-108-07: *Integrated Risk Management,* Doherty, Ch. 13: Contingent Leverage Strategies and Hybrid Debt
- FET-147-08: Financial Decision-Making: A Behavioral Perspective

- FET-148-08: Securitization of Life Insurance Assets and Liabilities
- FET-149-08: Are You Paying Too Much for That Acquisition?
- FET-150-08: Insurance Mergers &Acquisitions
- FET-151-08: Real and Illusory Value Creation by Insurance Companies, D. Babbel and C. Merrill, *Journal of Risk and Insurance*, 2005, Vol. 72, No.1, pp.1-21.
- FET-160-08: Megginson, W. L., *Corporate Finance Theory*, Ch. 9: Understanding and Accessing Financial Markets
- FET-161-08: Tiller & Tiller, *Life, Health and Annuity Reinsurance*, Ch. 5: Advanced Methods of Reinsurance
- FET-163-08: *Financial Markets and Corporate Strategy*, 2nd Edition, Grinblatt & Titman, Ch. 19: The Information Conveyed by Financial Decisions
- FET-165-08: *Integrated Risk Management,* Doherty, Ch. 16: A Case Study: The Securitization of Catastrophic Risk

3. Derivatives and Pricing

The candidate will be able to:
a. Define the cash flow characteristics of complex derivatives including exotic options, interest rate derivatives, swaps, and other non traditional derivatives.
b. Evaluate the risk/return characteristics of complex derivatives.
c. Identify embedded options in assets and liabilities.
d. Evaluate the impact of embedded options on risk/return characteristics of assets and liabilities.
e. Derive the Black Scholes Merton pricing formula.
f. Demonstrate mastery of option pricing techniques and theory for equity and interest rate derivatives.
g. Identify limitations of each option pricing technique.

Reading Materials:

- *Investment Guarantees*: *Modeling and Risk Management for Equity-Linked Life Insurance*, Hardy
    - Ch. 1 (pp.11-14): Provision for Equity-linked Liabilities
    - Ch. 2: Modeling Long-term Stock Returns
    - Ch. 3: Maximum Likelihood Estimation for Stock Return Models
    - Ch. 4: The Left-Tail Calibration Method
    - Ch. 5: Markov Chain Monte Carlo (MCMC) Estimation
- *Options Futures & Other Derivatives,* Hull, J.C., 7th Edition, 2008
    - Ch. 7: Swaps
    - Ch. 11: Binomial Trees
    - Ch. 12: Wiener Processes and Ito's Lemma
    - Ch. 13: The Black-Scholes-Merton model
    - Ch. 24: Exotic Options
    - Ch. 32: Swaps Revisited

- FET-101-09: Equity-Indexed Life Products
- FET-102-07: Variable Annuities: "No Loss" Propositions" (Sections 1 through 3.6 only)
- FET-153-08: What Does An Option Pricing Model Tell Us About Option Prices?
- FET-159-08: Babbel, D. & Fabozzi, F.J., *Investment Management for Insurers*, 3rd Edition, Ch 13: "Problems Encountered in Valuing Interest Rate Derivatives" by Y. Pierides
- FET-167-09: How to Use the Holes in Black-Scholes, Black, F.

4. Financial Modeling

The candidate will be able to:

a. Describe and evaluate equity and interest rate models

b. Contrast commonly used equity and interest rate models

c. Define and apply the concepts of martingale, market price of risk and measures in single and multiple state variable contexts

d. Describe and apply alternatives to the Black-Scholes-Merton model

e. Recommend an equity or interest rate model for a given situation

f. Describe issues and best practices in the estimation or calibration of financial models

g. Describe how option pricing models can be modified or alternatives techniques that can be used to deal with option pricing techniques' limitations.

h. Use numerical methods to effectively model complex assets or liabilities.

Reading Materials:

- *Investment Guarantees*: *Modeling and Risk Management for Equity-Linked Life Insurance*, Hardy
    - Ch. 6: Modeling the Guarantee Liability
    - Ch. 8: Dynamic hedging for separate account guarantees
    - Ch 12: Guaranteed Annuity Options
    - Ch 13: Equity-Indexed Annuities

- *Options Futures & Other Derivatives,* Hull, J.C.,7th Edition, 2008
    - Ch. 17: The Greek letters
    - Ch. 18: Volatility Smiles
    - Ch. 19 Basic Numerical Procedures
    - Ch. 21: Estimating Volatilities and Correlations
    - Ch. 26: More on Models and Numerical Procedures (26.1, 26.2, 26.3 only)
    - Ch. 27: Martingales and Measures
    - Ch. 28: Interest Rate Derivatives: The Standard Market Models
    - Ch. 29: Convexity, Timing, and Quanto Adjustments
    - Ch. 30: Interest Rate Derivatives: Models of the Short Rate
    - Ch. 31: Interest Rate Derivatives: HJM and LMM

- FET-106-07: Ho & Lee, *The Oxford Guide to Financial Modeling,* Ch. 5: Interest Rate Derivatives: Interest Rate Models and Ch. 6: Implied Volatility Surface: Calibrating the Models
- FET-152-08: Model Risk
- FET-155-08: Use of Stochastic Techniques to Value Actuarial Liabilities Under Canadian GAAP
- FET-158-09: Babbel & Fabozzi, *Investment Management for Insurers,* Ch. 11: "The Four Faces of an Interest Rate Model", by Fitton & McNatt
- FET-169-09: "Empirical Properties of Asset Returns: Stylized Facts and Statistical

Issues" by Rama Cont, Quantitative Finance Volume 1 (2001) 223–236

- Validation of Long-Term Equity Return Models for Equity-Linked Guarantees, by Hardy, Freeland and Till, NAAJ Vol. 10 No. 4, October 2006 (Sections 1-4 only) http://www.soa.org/library/journals/north-american-actuarial-journal/2006/october/naaj0604_3.pdf

5. Efficient Markets & Information Theory

a. Define capital market efficiency and the value of information.
b. Describe tests of efficiency and their implications for capital structure, portfolio management, and risk management.
c. Explain information asymmetry and how it can affect financial markets, especially insurance markets.
d. Define principal-agency theory and explain how it affects capital structure, portfolio management and risk management.
e. Define the elements of a game, including information sets, etc., Nash equilibrium, mixed strategies; explain the prisoners' dilemma and other special cases of a two-person, two-state, single period game, and explain the qualitative implications of repeated games.

Reading Materials:
- *Financial Theory and Corporate Policy*, Copeland, Weston, Shastri, 4th Edition,
    - Ch. 6: Market Equilibrium: CAPM and APT (pp. 164-188)
    - Ch. 10: Efficient Capital Markets: Theory
    - Ch. 11: Efficient Capital Markets: Evidence
    - Ch. 12: Information Asymmetry and Agency Theory
    - Ch. 15: Capital Structure and the Cost of Capital: Theory and Evidence
    - Ch. 16: Dividend Policy: Theory and Empirical Evidence

- FET-156-08: An Introduction to Applicable Game Theory, by Gibbons, R., *Journal of Economic Perspectives*, Winter 1997, pp. 127-149.

- FET-157-08: Finance Applications of Game Theory, by Allen and Morris, 1998.