



## STANFORD UNIVERSITY

Stanford Center for Professional Development

# Financial Engineering Program

### About the Program

The Stanford Financial Engineering Program provides students with a 5-module executive training led by world-renowned faculty from the Department of Management Science and Engineering at Stanford University and delivered in partnership with Stanford Center for Professional Development (SCPD).

Students in the program will learn to employ theoretical finance and computer modeling skills to make pricing, hedging, trading and portfolio management decisions. Courses and projects emphasize the practical applications of these skills.

The program will prepare participants for technically sophisticated jobs with organizations requiring comprehensive technical knowledge of arbitrage, hedging, futures and options pricing, portfolio management, trading, and dynamic investment strategies in bond, currency, options, and other financial markets.

Graduates of the Financial Engineering Program are prepared for careers in:

- Investment Banking
- Corporate Strategic Planning
- Risk Management
- Primary and Derivative Securities Valuation
- Financial Information Systems Management
- Portfolio Management
- Securities Trading

Upon successful completion, participants will be awarded a professional Certificate in Financial Engineering from Stanford University.

### Curriculum

The Program consists of five courses, each with approximately 24-26 hours of instruction. Courses are offered approximately every four to six weeks.

#### Investment Science

The foundations of the theory and application of modern quantitative investment analysis are presented from an engineering perspective. The course explores how investment concepts are used to evaluate and manage opportunities, portfolios, and investment products including stocks, bonds, mortgages, and annuities. Topics will include: deterministic cash flows (term structure of interest rates, bond portfolio immunization, project optimization); mean-variance theory (Markowitz model, capital asset pricing); and arbitrage pricing theory.

#### Options Theory and Practice

The financial industry was revolutionized by the development of the Black-Scholes method for pricing options. This fundamental concept has been extended in several ways and now is used to analyze and construct new financial products for various purposes. This course covers the theory of derivatives in general, but with special emphasis on the underlying theory of options. In particular, we will show various ways that stock behavior is modeled, including lattices and differential equations.

The theory of pricing will be presented for both types of models. In addition to the model of stock prices, we shall also consider the important models of interest rate fluctuations and the related theory of pricing

interest rate derivatives. The class will include many examples of various derivatives and the calculation of appropriate prices. Students will learn that there are several computational methods for finding prices, including lattices, Black-Scholes partial differential equations, and Monte Carlo methods. A special feature will be the theory of real options, which are options on physical commodities, projects, and other assets that are not traded securities. Participants in the class will have the opportunity to actually calculate the prices of several complex financial derivatives and using a laptop computer and the theory presented in this module.

### **Credit Risk Management**

Credit risk is the distribution of financial loss due to default of a counter party in a financial contract. This class describes a unified perspective of the quantitative analysis of credit risk. These tools will then be applied to the analysis, pricing and hedging of credit sensitive securities that are referenced on a single name, such as corporate bonds and credit default swaps (CDS). We discuss in detail the calibration of a pricing model to the market term structure of credit swap rates. We analyze the problem of forecasting a default event based on equity and equity option data, the testing of prediction systems, and the pricing of credit/equity hybrid derivatives such as equity default swaps. We then cover the mechanics and the pricing and hedging of credit derivatives such as cash collateralized debt obligations (CDO) and forwards and options on these instruments. We also consider the analysis of portfolio credit risk measurement. Most topics are accompanied by hands-on data-driven case studies, which exemplify model implementation. In this module, we also use the credit risk analysis to explain the underlying forces that cause the 2008 financial crisis.

### **Investment and Finance in China**

This course offers a practical, "real world" understanding of foreign investment in China and how financing is used for trade and investment in China. It offers highlights of China's development in finance since 1979, the beginning of the Open Policy. Through the "Current Events" portion of each class, the latest developments in investment and finance in China are discussed. The topics covered in the course will include:

- 1) China's banking system (with an excellent Caselet involving the process of issuing an international bond by a Chinese Province);
- 2) Foreign direct investment and alternatives to direct investment using actual cases (with probably 5 Caselets from different industries illustrating how one overcomes obstacles to establishing and running a JV or other entity in China);
- 3) Trade and trade finance (including a Caselet on how to solve disputes in China);
- 4) Infrastructure finance (a survey of power, telecoms, ports, roads and other infrastructure with 4 short Caselets);
- 5) China's stock markets and the process of listing a PRC company on the Stock Exchange of Hong Kong (with a Caselet involving bringing a Chinese company to the Hong Kong IPO market).

### **Two-Sided Market: A New Model for Business Innovation**

Traditional business models are based on a value chain structure where value is created and combined at each stage of the chain, from upstream to downstream. This is a good paradigm for traditional manufacturing industries. However, for many service industries, especially various financial service industries and many new web-based industries, value does not only flow from supplier to customer, value also flows from customer to supplier. A firm can serve as a platform that facilitates the value flow from one side to the other and creates a positive network effect: more customers on one side give more value to the other side and vice versa. For example, in the credit card industry, VISA and MasterCard are platforms with this characteristic: more merchants accepting a particular credit card will give both the holder of that card more value; and conversely more people holding a particular credit card give merchants more value in accepting that card. A brokerage trading firm is also a platform that facilitates the two-way value flow between consumers and firms offering financial products. The new model perspective gives rise to strategic innovations that counter conventional wisdom based on the value chain model. In this course, we shall apply the results derived from a two-sided market perspective to develop service innovation strategies for a financial service enterprise. Extensive cases are used to illustrate the concept.

## To Apply

To apply for admission to the Financial Engineering Program, candidates are required to possess a bachelor degree from an accredited institution and have at least three years of working experience.

To be considered for admission to the Financial Engineering Program Hong Kong, you must submit a complete portfolio of documents for evaluation:

- Completed application form
- Copy of transcripts
- Resume
- Personal Statement
- HK\$5000 cheque (Application fee\* and Registration fee\*) - Payable to "**China Education (EE) Ltd.**"

## Program Tuition

The Application Fee is HK\$500 and The Registration Fee is HK\$4500.

\* The HK\$500 application fee is non-refundable, regardless whether the student is accepted to the FE program or not.

\* The HK\$4500 registration fee will be refunded only if the application is not accepted by Stanford University.

\* The HK\$4500 registration fee will be counted towards the the tuition fee payment upon acceptance. For students who do not accept the admission offer, the fee is non-refundable.

The total tuition fee of the Financial Engineering Program is HK\$164,000 which covers

1. Lecture/ tutorial fee for all 5 modules
2. Textbooks/ comprehensive learning materials fee
3. Assessment fee

## Payment Schedule

1. One-off

## Admission to the Stanford Master of Science Graduate Program

Students who have successfully completed the Program and possess necessary qualifications including GRE scores could apply to the MS&E Master of Science graduate program. They will be reviewed together with other MS applicants and will be admitted based on Stanford's admission process.

Students admitted to the MS program can complete the remainder of their study either online while working full-time which is an attractive alternative to students with strong quantitative skills and focused career interests. The entire MS program can be completed on Stanford's campus with one year of study.

To be admitted to MS program, candidates are expected to demonstrate a high level of intellectual curiosity, a strong interest in finance, and strong analytical skills. Though there is no specific entrance requirement, most students in the MS program will have backgrounds in quantitative disciplines such as mathematics, statistics, the physical sciences, engineering, operations research, computer science, finance, or economics. It is also expected, though not required, that applicants have work or research experience in which they have applied quantitative skills creatively.

Whether students are admitted to the MS graduate program or not, the Stanford Financial Engineering Certificate program gives prospective applicants a solid understanding and background in Management Science and Engineering.

## Faculty

### Professor David Luenberger, Program Co-Director

Professor Luenberger received his BS from California Institute of Technology, MS and PhD from Stanford University. He has made numerous contributions in systems control, economics, optimization and financial engineering. He has published six text books in various fields, including system theory, optimization, investment, and information science. His book "Investment Science" is now a standard text book in the field of financial engineering. The book has been translated in many languages, including Chinese. He is a Fellow of IEEE and has served as the President of Society of Economic Dynamics and Control from 1987 to 1988. He served as the Technical Assistant to the Director, U.S. Office of Science and Technology, Executive Office of the President, Washington DC from 1971-1972.

He has served as a consultant to many companies, including Westinghouse; Stanford Research Institute;

Systems Control, Inc.; Optimization Technology, Inc.; and Citicorp. He is a member of the Econometric Society, Society for Economic Dynamics and Control, Society for the Promotion of Economic Theory, Institute for Operations Research, and INFORMS.

### **Professor Edison Tse, Program Co-Director**

Professor Tse received his BS, MS, and PhD in Electrical Engineering from the Massachusetts Institute of Technology. He is the Director of the Asia Center in Stanford's Department of Management Science and Engineering, which has the charter of developing executive training programs and establishing research affiliations with Asian enterprises with a special focus in Greater China: China, Hong Kong, and Taiwan. He received the prestigious Donald Eckman Award in 1973 from the American Automatic Control Council in recognition of his outstanding contribution in the field of Automatic Control. He co-founded and has served as a co-editor of the Journal of Economic Dynamics and Control. He has published over 150 papers on his research activities. He co-founded Advanced Decision System which was later acquired by Booz Allen and Hamilton in 1991. Since March 2003, he had been teaching in EMBA programs in several Chinese Universities on the topic "Dynamic Corporate Strategy in Uncertain Business Environment". Through the Asia Center, he developed an Executive Certificate Program jointly with the Enterprise Research Institute of Development Research Center of the State Council of PRC. This certificate program is specially designed for top executives in Chinese enterprises. In 2006, Tse developed a customized Policy Analysis Program at Stanford University for top Chinese government officials and was appointed as an outside Board Director by a Chinese fund management company. In the last three years, he has consulted with Chinese private enterprises to help them in corporate restructuring and implementation of a breakthrough strategy that can bring the enterprise into the next phase of growth.

### **Professor James Primbs**

Professor Primbs received his PhD in Control and Dynamical Systems from California Institute of Technology in 1999 for work in the area of receding horizon control. Following that, he was a post-doctoral researcher for two years focusing on financial engineering. In 2001 he joined the Management Science and Engineering Department at Stanford where he is an award-winning teacher of courses including Investment Science and Advanced Topics in Financial Engineering. His research involves developing control theory, especially in the area of receding horizon control, oriented toward applications in financial engineering. His numerous publications have appeared in journals such as Quantitative Finance, Applied Math Finance, Automatica, IEEE Transactions on Automatic Control, and others. At Stanford, he serves on the steering committee for the master's degree program in financial mathematics. He has co-organized international workshops on financial engineering, and teaches a one-day short course on Finance for Control Systems Engineers.

### **Professor Kay Giesecke**

Professor Giesecke is an Assistant Professor of Management Science & Engineering at Stanford University and a faculty member of Stanford's Financial Mathematics Program. Kay's research and teaching address the quantitative modeling of financial risk, in particular credit risk. His research has been funded by grants from JP Morgan, American Express and Moody's Corporation. Kay has served as a consultant to financial institutions and the European Commission. Prior to joining Stanford in 2005, he taught financial engineering at Cornell University's School of Operations Research and Information Engineering. Kay holds an MSc in Electrical Engineering and Economics and a PhD in Economics from Humboldt University Berlin, Germany.

### **Laurence C. Franklin**

Professor Franklin holds MBA and Juris Doctor degrees from Stanford University, and is a Certified Public Accountant. He has taught more than 150 MBA and EMBA level courses. In addition to his MBA teaching at HKUST, he has taught in the MBA programs at the Stanford, Chicago, MIT Sloan, Darden (U.Virginia) and Tsinghua in Beijing. He has taught in the Executive MBA programs at HKUST (Beijing), Chicago, MIT Sloan, Kellogg-HKUST, Kellogg-Recanati (Israel), Kellogg-WHU (Germany), Kellogg-Schulich (Canada), Donau Krems (Austria) and China-Europe International Business School (CEIBS) in Shanghai and Beijing.

Professor Franklin is honored to have received 70 Excellence in Teaching citations from the MBA courses he has taught. Larry Franklin has been doing business in China since 1981, as a lawyer, commercial banker, investment banker, China advisor and equity investor. He has worked on more than 150 transactions in China and successfully completed 60 investments and financings, raising over US\$5 billion in funds for China projects. Larry's publications include *Establishing a Holding Company in China*, a 30-page Chapter in *Obtaining PRC Approvals*, 300 pps., published by Euromoney's Asia Law & Practice, January, 2000.

## **About the Stanford Center for Professional Development**

The Stanford Center for Professional Development makes it possible for working professionals worldwide to become part of the spirit of innovation and openness at Stanford University by delivering graduate-level education -- Master of Science degrees, certificates, and individual courses -- online, on campus and at the work site. Visit SCPD's site at <http://scpd.stanford.edu/>

## **About the Stanford's Department of Management Science and Engineering**

Stanford's School of Engineering was founded in 1925 and is comprised of nine academic departments. Undergraduate program ranking and graduate program ranking show evidence of the school's premier standing. Its stellar faculty includes a Nobel laureate, winners of the National Medal of Science and other prestigious honors. Additionally, many faculty members are recipients of distinguished endowed professorships. The school has strong ties to industry through membership of the Advisory Council, the Dean's Strategic Council, numerous industrial affiliates programs, and individual faculty relationships.

The Department of Management Science and Engineering (MS&E) provides education and research associated with the development of knowledge, tools and methods required to make decisions and required to shape policies, to configure organizational structures, to design engineering systems, and to solve operational problems associated with the information-intensive, technology-based economy.

## **About Stanford University**

Recognized as a leading research and teaching institution, Stanford has one of the most renowned faculties in the world. The University is committed to offering students an education that is unrivaled among research universities. Stanford University is an incredibly exciting and diverse community that offers remarkable breadth in both academic and extracurricular activities.

The pioneering spirit that inspired Jane and Leland Stanford to start this university more than a century ago and that helped build Silicon Valley at the doorstep of the campus encourages boldness in every endeavor - whether in the library, the classroom, the laboratory, or on the athletic field.

Today, Stanford has 1,749 tenure-line faculty, senior fellows and center fellows across eight Schools at the University, and at specified policy centers and institutes, and the Medical Center. Fifty-four percent of the faculty have tenure. Faculty at Stanford are expected to be among the best teachers and researchers in their fields. There are 363 faculty members appointed to endowed chairs. Twenty-five Stanford faculty have won a Nobel Prize since the university's founding.



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## **Contact information**

To apply or for more information, please contact our representative in Hong Kong:



China Education Group

**China Education Group**

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**18 Harcourt Road, Admiralty, Hong Kong**