Financial Engineering Emphasis Area

Financial engineering is a multidisciplinary field that deals primarily with financial instruments, especially derivative securities. The field applies engineering methodologies to problems in finance, and employs financial theory and applied mathematics, as well as computation and the practice of programming to make pricing, hedging, trading and portfolio management decisions.

Utilizing various derivative securities and other methods, financial engineering aims to precisely control the financial risk (both market and credit) that an entity takes on. Methods can be employed to take on unlimited risks under certain events, or completely eliminate other risks by utilizing combinations of derivative and other securities.

Financial engineering can be applied to many different types of currencies and pricing options. These include equity, fixed income such as bonds, commodities such as oil or gold, as well as derivatives, swaps, futures, forwards, options, and embedded options.

Industrial Engineering graduates bring a unique perspective to these financial analyses due to the nature of the discipline and the techniques and skills acquired as part of the Industrial Engineering curriculum. Because of the breadth of engineering education and the mathematical focus of much of the discipline, Industrial Engineering graduates frequently find good opportunities with banks, financial management and consulting companies, and other firms that deal with securities and/or perform quantitative analyses.

Financial engineering specialists have extensive knowledge of:
- Financial mathematics
- Stochastic processes
- Optimization
- Simulation
- Economics

Financial engineering specialists have effective technical skills in:
- Programming
- Data manipulation and analysis
- Modeling and problem-solving

Courses

Courses taken from the following groupings help to provide students with a deeper understanding of financial engineering. More information on each of these courses can be obtained by logging onto myPurdue, navigating to the course catalog page for that department and clicking on the link for the course.

The courses listed below are listed in the course catalog for each department. They are meant to provide guidance as to what a student might take if they are interested in this emphasis area. The list of courses below is not exhaustive. In addition, the regularity of offerings of the listed courses is not guaranteed. Some courses are offered every semester, every other semester, or every other year. Other courses may have been offered at some point, but may not be offered again for a while, and we keep them in this list in hopes they will be offered again. Therefore, the courses listed here should be considered an unreliable source of information. A student wishing to take a particular course should always check the course schedule (via "Look Up Classes" in myPurdue) to see what is available.
Legend:
REQ: Required for IE majors
TE: Technical Elective
GE: General Education Elective
*: Course has not yet been pre-approved by the IE faculty as a TE, but approval is pending. A student may wish to petition for the immediate approval.

Basics of Financial instruments
- MA 373: Financial Mathematics *
- IE 590: Introduction to Financial Engineering (TE)
- MGMT 441: Futures and Options *
- MGMT 412: Financial Markets and Institutions *
- MGMT 411: Investment Management *

Modeling and Problem-Solving
- Differential Equations:
  a. MA 266: Ordinary Differential Equations (REQ)
  b. MA 303: Differential Equations and Partial Differential Equations for Engineering and the Sciences *
  c. MA 366: Ordinary Differential Equations *
  d. MA 428: Fourier Analysis *
- Statistics:
  a. IE 230: Probability And Statistics In Engineering I (REQ)
  b. IE 330: Probability And Statistics In Engineering II (REQ)
  c. STAT 420: Introduction to Time Series *
  d. STAT 512: Applied Regression Analysis (TE)
- Stochastic Modeling:
  b. IE 536: Stochastic Models in Operations Research (TE)

Simulation and Programming
- ECE 462: Object-oriented Programming Using C++ and Java
- IE 581: Simulation Design and Analysis (TE)
- CS 314: Numerical Methods (TE)

Economics
- ECON 251: Microeconomics (GE)
- ECON 252: Macroeconomics (GE)
- ECON 340: Intermediate Microeconomic Theory (GE)
- ECON 352: Intermediate Macroeconomic Theory (GE)
- IE 343: Engineering Economics (REQ)

Related faculty in IE
- Agostino Capponi
- Thomas Morin

Relevant links
- Computational Finance Program in the Department of Statistics at Purdue
DISCLAIMER: The emphasis area document is intended for use as an aid to students for developing a coherent curriculum plan. The courses listed are a representation of the courses that may be taken (or are taken as part of the IE curriculum) that develop skills that are needed for a career in a field focusing on this emphasis area. While we list required IE courses, students should strongly consider enhancing their base IE coursework with more advanced courses in one or more of the areas.