

## **INSURANCE AND RISK MANAGEMENT (WH) {INSR}**

### **205. (INSR805) Risk Management. (C) Staff.** Prerequisite(s): None.

This course describes the concepts and techniques available to corporations, non-profit organizations, and other organizations in their efforts to manage pure risks. The costs associated with such pure risks as product liability, environmental impairments, property losses, work-related injuries, and employee benefits (e.g., pensions, health insurance, etc.) affect the daily management of organizations. Managers who make decisions without appropriate consideration of risk management issues can jeopardize the long-term survival of their organizations. The course examines a common set of techniques which can be used by managers in dealing with these problems, including risk assumption, prevention, diversification, and transfer via insurance and non-insurance market mechanisms. In turn, students learn to recognize that the institutional structure of the organization itself influence its own risks and their corresponding treatments.

### **210. (INSR835) Financial Strategies and Analysis: Insurance. (C) Kartasheva.** Prerequisite(s): Good understanding of capital markets, insurance markets, and statistics.

This course is designed to apply and expand upon the theories and methodologies taught in finance to the complex and specific needs of managing financial risk in the insurance enterprise. The types of financial risks that today's insurance professionals face come from both the asset and liability sides of the balance sheet and thus require a wide range of modeling tools. Concurrently, the tools used in the modeling of interest-rate risk, equity risk, and default risk have become increasingly important in an era of increasing convergence between the insurance industry and financial capital markets. This course will introduce several risk management models designed to allow insurance professional to measure and manage each source of risk. We develop and critique theoretical models for each type of risk while strong emphasis is placed on the implementation and calibration of various models. Projects include the risk management and pricing of Variable Equity Indexed Annuities and Guaranteed Investment Contracts.

This course is intended for students with concentration(s) in Insurance, Finance, and Actuarial Science considering a career in the insurance industry or financial services sector.

### **221. (INSR822, INSR922) Employee Benefit Plan Design and Financing. (C) Mitchell.** Prerequisite(s): None.

Large U.S. employers devote up to 40% of payroll on non-wage benefits, and in other countries, the ratio is higher. What rationales justify such a substantial budget commitment to employee benefits? How are benefit packages designed and how do they evolve to achieve multiple ends? Course units cover aspects of life insurance, health and disability insurance, and deferred compensation plans along with the economic consequences of and regulatory environment shaping each. Executive compensation is also covered. This course is useful to anyone interested in health care, insurance and retirement planning, for either professional or personal reasons.

### **222. (INSR823) Business Insurance and Estate Planning. (C) Hallman.** Prerequisite(s): None.

This course presents an analysis of overall private wealth management. This includes planning for disposition of closely-held business interests; the impact of income taxes and other transfer costs on business interests and other assets; integration of life insurance, disability insurance, medical benefits, and long-term care insurance in the financial plan; planning for concentrated asset (e.g., common stock) positions, diversification techniques, and asset allocation strategies; distribution of retirement assets; lifetime giving and estate planning; and analysis of current developments in the creation, conservation, and distribution of estates. Attention also is given to various executive compensation techniques (including restricted stock and stock options) and planning for various employee benefits. The course also covers sophisticated charitable giving techniques and methods for financing education expenses. Readings consist of textbook, case studies, and bulk pack articles.

This course should be attractive to most students to help them plan for their own or their families' financial affairs. It also should be particularly attractive to students specializing in entrepreneurship, wealth management finance, and law.

### **230. (INSR825) Managing Pure Risks: Operations and Markets. (A) staff.** Prerequisite(s): None.

This course deals with property-liability insurance company financial management "alternative market" mechanisms for managing pure risks such as captive insurance companies, and the securitization of risk-linked bonds and other instruments. It involves extensive discussion of insurance company financial strategies including investments, asset-liability management, value-at-risk, capital estimation, and financial reporting. Additional topics include product distribution and marketing systems, underwriting operations and policy, reinsurance, rate-making and reserves, claims, accounting, and other functions of insurance risk pools. The regulation and taxation of insurance and captive insurance companies are also covered. A number of public policy issues affecting the management of property-liability insurers

are discussed including: insurer solvency and state guarantee funds, discrimination in property-liability insurance pricing, the effect of the underwriting cycles, and the convergence of the financial services sector. The characteristics of the property-liability insurance industry also are studied within the framework of the financial services industry.

**232. (INSR827, INSR927) Risk Management and Treatment. (B)** staff. Prerequisite(s): None.

Nature and objectives of corporate risk management. Primary consideration devoted to the recognition, evaluation, and treatment of pure risks to which the corporation is exposed.

**251. (INSR829) Fundamentals of Actuarial Science I. (A)** Lemaire. Prerequisite(s): One semester of calculus.

This course is the usual entry point in the actuarial science program. It is required for students who plan to concentrate or minor in actuarial science. It can also be taken by others interested in the mathematics of personal finance and the use of mortality tables. For future actuaries, it provides the necessary knowledge of compound interest and its applications, and basic life contingencies definition to be used throughout their studies. Non-actuaries will be introduced to practical applications of finance mathematics, such as loan amortization and bond pricing, and premium calculation of typical life insurance contracts. Main topics include annuities, loans and bonds; basic principles of life contingencies and determination of annuity and insurance benefits and premiums.

**252. (INSR830) Fundamentals of Actuarial Science II. (B)** Lemaire. Prerequisite(s): INSR 251.

This specialized course is usually only taken by Wharton students who plan to concentrate in actuarial science and Penn students who plan to minor in actuarial mathematics. It provides a comprehensive analysis of advanced life contingencies problems such as reserving, multiple life functions, multiple decrement theory with application to the valuation of pension plans.

**253. (INSR833) Actuarial Statistics. (A)** Lemaire. Prerequisite(s): Math 140-141 or equivalent, Stat 101-102 or 430-431 or equivalent.

This course covers models for insurer's losses, and applications of Markov chains. Poisson processes, including extensions such as non-homogeneous, compound, and mixed Poisson processes are studied in detail. The compound model is then used to establish the distribution of losses. An extensive section on Markov chains provides the theory to forecast future states of the process, as well as numerous applications of Markov chains to insurance, finance, and genetics. The course is abundantly illustrated by examples from the insurance and finance literature. While most of the students taking the course are future actuaries, other students interested in applications of statistics may discover in class many fascinating applications of stochastic processes and Markov chains.

**260. (INSR831) Applied Statistical Methods for Actuaries. (B)** Lemaire. Prerequisite(s): One semester of probability.

One half of the course is devoted to the study of time series, including ARIMA modeling and forecasting. The other half studies modifications in random variables due to deductibles, co-payments, policy limits, and elements of simulation. This course is a possible entry point into the actuarial science program. No INSR course is a pre-requisite for INSR 831. The Society of Actuaries has approved INSR 831 for VEE credit on the topic of time series.

**299. Independent Study. (C)** Staff.

**805. (INSR205) Risk Management. (C)** Staff. Prerequisite(s): None. None.

This course describes the concepts and techniques available to corporations, non-profit organizations and other organizations in their efforts to manage pure risks. The costs associated with such pure risks as product liability, environmental impairments, property losses, work-related injuries, and employee benefits (e.g., pensions, health insurance, etc.) affect the daily management of organizations. Managers who make decisions without appropriate consideration of risk management issues can jeopardize the long-term survival of their organizations. The course examines a common set of techniques which can be used by managers in dealing with these problems, including risk assumption, prevention, diversification, and transfer via insurance and non-insurance market mechanisms. In turn, students learn to recognize that the institutional structure of the organization itself influence its own risks and their corresponding treatments.

**811. Risk and Crisis Management. (C)** Staff. Prerequisite(s): None.

The success of any firm depends jointly on its ability to create value and on its ability to preserve value. The creation of value arises when a firm is able to identify and execute investments with a positive net present value. The creation of value invariably exposes the firm to risk and this value can easily be jeopardized. A fall in demand for its product, a sudden rise in production or financing costs, a technological failure, destruction of assets or information, a liability suit, or the activities of a rogue trader, each can squander the value created. In extreme cases these risky possibilities can bankrupt the firm. Risk management is becoming increasingly important and firms are devoting increasing time, attention and resources to deriving strategies for preserving value. These strategies include, hedging, insurance,

contingent financing and changes in organizational design which make the firm more robust to shocks. Risk and Crisis Management will look at these and related strategies. (Mini course - 6 weeks).

**812. Markets for Pure Risk. (C)** Cummins. Prerequisite(s): Basic microeconomics and finance.

This course examines the supply side of global markets for pure risks. Pure risks can be broadly defined as risks that are beyond the core competencies of the majority of firms in the economy. These are risks that must be managed or avoided in order to enable management to add value by focusing on the firm's primary activity. An important category of pure risks encompasses those risks that traditionally were managed by purchasing insurance - the risk of reduction of firm value due to fires, natural disasters, liability lawsuits, work injuries, and other types of accidents or legal actions. However, pure risks also include other sources of volatility that have not traditionally been traded in insurance markets. The latter category includes weather risk, credit risk, and foreign exchange risk, among others. The course examines insurance and financial markets, "alternative market" approaches to dealing with pure risks such as captive insurance companies, the global market for reinsurance, and markets for securitized risk products such as catastrophe bonds, mortality index bonds, and life insurance reserve financing securitizations.

This course is intended to complement Insurance 811, "Risk and Crisis Management." INSR 811 focuses on how firms can use various types of hedging instruments to manage pure risks, i.e. its emphasis is primarily on the demand side of markets for pure risks, whereas INSR 812 examines the supply side of these markets. (Mini course - 6 weeks)

**822. (INSR221, INSR922) Employee Benefit Plan Design and Financing. (C)** Mitchell. Prerequisite(s): None.

Large U.S. employers devote up to 40% of payroll on non-wage benefits, and in other countries, the ratio is higher. What rationales justify such a substantial budget commitment to employee benefits? How are benefit packages designed and how do they evolve to achieve multiple ends? Course units cover aspects of life insurance, health and disability insurance, and deferred compensation plans along with the economic consequences of and regulatory environment shaping each. Executive compensation is also covered. This course is useful to anyone interested in health care, insurance and retirement planning, for either professional or personal reasons.

**823. (INSR222) Business Insurance and Estate Planning. (C)** Hallman. Prerequisite(s): None.

This course presents an analysis of overall private wealth management. This includes planning for disposition of closely-held business interests; the impact of income taxes and other transfer costs on business interests and other assets; integration of life insurance, disability insurance, medical benefits, and long-term care insurance in the financial plan; planning for concentrated asset (e.g., common stock) positions, diversification techniques, and asset allocation strategies; distribution of retirement assets; lifetime giving and estate planning; and analysis of current developments in the creation, conservation, and distribution of estates. Attention also is given to various executive compensation techniques (including restricted stock and stock options) and planning for various employee benefits. The course also covers sophisticated charitable giving techniques and methods for financing education expenses. Readings consist of textbook, case studies, and bulk pack articles.

This course should be attractive to most students to help them plan for their own or their families' financial affairs. It also should be particularly attractive to students specializing in entrepreneurship, wealth management finance, and law.

**824. (INSR924) Social Insurance. (A)** Smetters. Prerequisite(s): Micro economics; statistics or basic econometrics.

This course presents and evaluates economic rationales for social insurance programs in the developed and developing world. We explore how social insurance programs are designed and implemented in theory and practice, and examine what their economic effects are on key players' behaviors. Topics include systems protecting against unemployment, disability, poverty, old age, and medical care expenses. We examine the relative roles of private versus governmentally-provided benefit programs, focusing on financing and benefit provision. Special attention is devoted to recent and ongoing real-world experiments with privatization.

**825. (INSR230) Managing Pure Risks: Operations and Markets. (A)** staff. Prerequisite(s): None.

This course deals with property-liability insurance company financial management "alternative market" mechanisms for managing pure risks such as captive insurance companies, and the securitization of risk-linked bonds and other instruments. It involves extensive discussion of insurance company financial strategies including investments, asset-liability management, value-at-risk, capital estimation, and financial reporting. Additional topics include product distribution and marketing systems, underwriting operations and policy, reinsurance, rate-making and reserves, claims, accounting, and other functions of insurance risk pools. The regulation and taxation of insurance and captive insurance companies are also covered. A number of public policy issues affecting the management of property-liability insurers are discussed including: insurer solvency and state guarantee funds, discrimination in property-liability insurance pricing, the effect of the underwriting cycles, and the convergence of the financial services sector. The characteristics of the property-liability insurance industry also are studied within the framework of the financial services industry.

**827. (INSR232, INSR927) Risk Management and Treatment. (B)** staff. Prerequisite(s): None.

Nature and objectives of corporate risk management. Primary consideration devoted to the recognition, evaluation, and treatment of pure risks to which the corporation is exposed.

**829. (INSR251) Fundamentals of Actuarial Science I. (A)** Lemaire. Prerequisite(s): One semester of calculus.

This course is the usual entry point in the actuarial science program. It is required for students who plan to concentrate or minor in actuarial science. It can also be taken by others interested in the mathematics of personal finance and the use of mortality tables. For future actuaries, it provides the necessary knowledge of compound interest and its applications, and basic life contingencies definition to be used throughout their studies. Non-actuaries will be introduced to practical applications of finance mathematics, such as loan amortization and bond pricing, and premium calculation of typical life insurance contracts. Main topics include annuities, loans and bonds; basic principles of life contingencies and determination of annuity and insurance benefits and premiums.

**830. (INSR252) Fundamentals of Actuarial Science II. (B)** Lemaire. Prerequisite(s): INSR 829.

This specialized course is usually only taken by Wharton students who plan to concentrate in actuarial science and Penn students who plan to minor in actuarial mathematics. It provides a comprehensive analysis of advanced life contingencies problems such as reserving, multiple life functions, multiple decrement theory with application to the valuation of pension plans.

**831. (INSR260) Applied Statistical Methods for Actuaries. (B)** Lemaire. Prerequisite(s): One semester of probability.

One half of the course is devoted to the study of time series, including ARIMA modeling and forecasting. The other half studies modifications in random variables due to deductibles, co-payments, policy limits, and elements of simulation. This course is a possible entry point into the actuarial science program. No INSR course is a pre-requisite for INSR 831. The Society of Actuaries has approved INSR 831 for VEE credit on the topic of time series.

**833. (INSR253) Actuarial Statistics. (A)** Lemaire. Prerequisite(s): Two semesters of Statistics.

This course covers models for insurer's losses, and applications of Markov chains. Poisson processes, including extensions such as non-homogeneous, compound, and mixed Poisson processes are studied in detail. The compound model is then used to establish the distribution of losses. An extensive section on Markov chains provides the theory to forecast future states of the process, as well as numerous applications of Markov chains to insurance, finance, and genetics. The course is abundantly illustrated by examples from the insurance and finance literature. While most of the students taking the course are future actuaries, other students interested in applications of statistics may discover in class many fascinating applications of stochastic processes and Markov chains.

**835. (INSR210) Financial Strategies and Analysis: Insurance. (C)** Kartasheva. Prerequisite(s): Good understanding of capital markets, insurance markets, and basic statistics.

This course is designed to apply and expand upon the theories and methodologies taught in finance to the complex and specific needs of managing financial risk in the insurance enterprise. The types of financial risks that today's insurance professionals face come from both the asset and liability sides of the balance sheet and thus require a wide range of modeling tools. Concurrently, the tools used in the modeling of interest-rate risk, equity risk, and default risk have become increasingly important in an era of increasing convergence between the insurance industry and financial capital markets. This course will introduce several risk management models designed to allow insurance professional to measure and manage each source of risk. We develop and critique theoretical models for each type of risk while strong emphasis is placed on the implementation and calibration of various models. Projects include the risk management and pricing of Variable Equity Indexed Annuities and Guaranteed Investment Contracts.

**890. Advanced Study Project. (C)** Staff.

**891. Thesis Supervision. (C)**

**899. Independent Study. (C)** Staff.

**922. (INSR221, INSR822) Employee Benefit Plan Design and Financing. (C)** Mitchell. Prerequisite(s): None.

Large U.S. employers devote up to 40% of payroll on non-wage benefits, and in other countries, the ratio is higher. What rationales justify such a substantial budget commitment to employee benefits? How are benefit packages designed and how do they evolve to achieve multiple ends? Course units cover aspects of life insurance, health and disability insurance, and deferred compensation plans along with the economic consequences of and regulatory environment shaping each. Executive compensation is also covered. This course is useful to anyone interested in health care, insurance and retirement planning, for either professional or personal reasons.

**924. (INSR824) Social Insurance. (A)** Smetters. Prerequisite(s): Some economics and econometrics desirable.

This course presents and evaluates economic rationales for social insurance programs in the developed and developing world. We explore how social insurance programs are designed and implemented in theory and practice, and examine what their economic effects are on key players' behaviors. Topics include systems protecting against unemployment, disability, poverty, old age, and medical care expenses. We examine the relative roles of private versus governmentally-provided benefit programs, focusing on financing and benefit provision. Special attention is devoted to recent and ongoing real-world experiments with privatization.

**926. Markets for Pure Risk. (C)** Staff. Prerequisite(s): INSR 825, preferred but not required.

This course deals with economic and financial issues in property-liability insurance. The focus is on the economics of the property-liability insurance industry and on economic and financial aspects of property-liability insurance company management. The course begins by studying the structure of the property-liability insurance industry and its role in the economy. Among the key issues are profit cycles, insurance stock performance, and price and availability problems. The course then moves to a micro level, analyzing the economics of insurance company operations. The role of underwriting is discussed in the context of economic models of asymmetric information and adverse selection. The efficiency of alternative marketing technologies is considered. A major course segment is devoted to financial models for pricing property-liability contracts and their implications for company management and market behavior. A final major course segment deals with the impact on insurance markets of price and solvency regulation.

**SM 932. Empirical Modeling for Risk and Insurance. (B)** Nini and Smetters. Prerequisite(s): None.

This doctoral course will provide tools and methods to test the models and measure the parameters of interest in the microeconomics of decision-making under uncertainty; provides an understanding of the settings in which these concepts operate; and evaluates conditions under which programs designed to manage risk can have unanticipated or undesirable consequences. Students will have two main goals:

- To develop cutting-edge tools and methods to estimate or measure key parameters and phenomena central to the study of insurance, risk, and risk management

- To develop an understanding of the design, structure, and impact of plans and policies designed to manage risk.

**934. Economics of Risk and Information. (A)** Kartasheva. Prerequisite(s): Economics (Basic).

This course deals with the economic theory of supply, demand, and equilibrium in insurance markets. The course will review decision models under conditions of risk, use these to address problems of optimal insurance, moral hazard and adverse selection, classification, contract enforcement and fraud. The course also looks at instability in insurance markets.

**999. Independent Study. (C)**