**ACTUARIAL SCIENCE (ACTS)**

**ACTS 399 Independent Study**

*Prerequisites:* Permission.

*Credit Hours:* 1-3

*Min credits per semester:* 1

*Max credits per degree:* 24

*Grading Option:* Graded with Option

**ACTS 401 Problem Lab: Basic Actuarial Applications of Probability**

*Prerequisites:* MATH 208 or 208H and STAT 462, or parallel, and both with a grade of "Pass" or "C" or better.

*Description:* Calculus-based probability, both univariate and multivariate, applications to risk management-related problems. Problems as posed in the Society of Actuaries (SOA) Exam "P" and/or Casualty Actuarial Society (CAS) Exam "1". Determination of loss frequency distributions and their characteristics, expected value, variance, and percentiles. Determination of loss severity distributions and their characteristics, expected value, variance, and percentiles. Determination of loss sharing parameters, deductibles, and maximum payments.

*Credit Hours:* 1

*Max credits per semester:* 1

*Max credits per degree:* 1

*Grading Option:* Graded

**ACTS 402 Problem Lab: Basic Actuarial Applications of Financial Mathematics**

*Prerequisites:* ACTS 440/840 or parallel

*Description:* Application of basic mathematics of finance to problems involving valuation of financial transactions. Problems as posed in the Society of Actuaries (SOA) Exam "FM" and/or Casualty Actuarial Society (CAS) Exam "2". Determination of expected value, variance, and percentiles. Determination of loss frequency distributions and their characteristics, expected value, variance, and percentiles. Determination of loss severity distributions and their characteristics, expected value, variance, and percentiles. Determination of loss sharing parameters, deductibles, and maximum payments.

*Credit Hours:* 1

*Max credits per semester:* 1

*Max credits per degree:* 1

*Grading Option:* Graded

**ACTS 403 Problem Lab: Actuarial Models - Life Contingencies**

*Prerequisites:* ACTS 470/870, ACTS 471/871, and ACTS 473/873

*Description:* Problems as posed in the Society of Actuaries (SOA) Exam "M" and/or Casualty Actuarial Society (CAS) Exam "3". Survival and severity models; Markov Chain models; life contingencies; and "Poisson" processes.

*Credit Hours:* 1

*Max credits per semester:* 1

*Max credits per degree:* 1

*Grading Option:* Graded

**ACTS 404 Problem Lab: Construction and Evaluation of Actuarial Models**

*Prerequisites:* ACTS 410 and 425

*Description:* Problems as posed in the Society of Actuaries (SOA) Exam "C" and/or Casualty Actuarial Society (CAS) Exam "4". Construction of empirical models; construction and selection of parametric models; credibility theory; interpolation and smoothing of data; and simulation.

*Credit Hours:* 1

*Max credits per semester:* 1

*Max credits per degree:* 1

*Grading Option:* Graded

**ACTS 405 Problem Lab: Actuarial Models - Financial Economics**

*Prerequisites:* ACTS 440/840 and FINA 467

*Description:* Problems as posed in the Society of Actuaries (SOA) Exam "M". Interest rate models; rational valuation of derivative securities (option pricing: put-call parity, the binomial model, Black-Scholes formula, and actuarial applications; interpretation of option Greeks and delta-hedging; features of exotic options; an introduction to Brownian motion and Itô's lemma); and risk management techniques.

*Credit Hours:* 1

*Max credits per semester:* 1

*Max credits per degree:* 1

*Grading Option:* Graded

**ACTS 410 Introduction to Credibility, Smoothing of Data, and Simulation**

*Crosslisted with:* ACTS 810

*Prerequisites:* STAT 463

*Description:* Full, partial, Buhlmann, and Buhlmann-Straub credibility models. Introduction to empirical Bayes and statistical distributions used to model loss experience. Application of "polynomial splines" to actuarial data. Simulation of "discrete" and "continuous random" variables in context of actuarial models. Simulation to "p-value" of hypothesis test. "Bootstrap method" of estimating the "mean squared error" of an estimator.

*Credit Hours:* 3

*Max credits per semester:* 3

*Max credits per degree:* 3

*Grading Option:* Graded

**ACTS 425 Survival Models**

*Crosslisted with:* ACTS 825

*Prerequisites:* STAT 463 with a grade of "C" or better

*Description:* Parametric and tabular survival models. Estimation based on observations that might not be complete. Concomitant variables. Use of population data. Applications to groups with impaired lives.

*Credit Hours:* 3

*Max credits per semester:* 3

*Max credits per degree:* 3

*Grading Option:* Graded

**ACTS 430 Actuarial Applications of Applied Statistics**

*Crosslisted with:* ACTS 830

*Prerequisites:* STAT 463 with a grade of "C" or better

*Description:* Data sets processed and analyzed using statistical software. Introduction to forecasting in actuarial science. Simple and multiple regression, instrumental variables, time series methods, and applications of methods in forecasting actuarial variables. Interest rates, inflation rates, and claim frequencies.

*Credit Hours:* 3

*Max credits per semester:* 3

*Max credits per degree:* 3

*Grading Option:* Graded
ACTS 440 Interest Theory  
Crosslisted with: ACTS 840  
Prerequisites: MATH 208 or 208H with a grade of "Pass" or "C" or better, or parallel  
Notes: Grade only  
Description: Application of financial mathematics to problems involving valuation of financial transactions; equivalent measures of interest; rate of return on a fund; discounting or accumulating a sequence of payments with interest; and yield rates, length of investment, amounts of investment contributions or amounts of investment returns for various types of financial transactions; loans and bonds. Introduction to the mathematics of modern financial analysis. Calculations involving yield curves, spot rates, forward rates, duration, convexity, and immunization.  
Credit Hours: 4  
Max credits per semester: 4  
Max credits per degree: 4  
Grading Option: Graded  
Prerequisite for: ACTS 450; ECON 365, FINA 365; FINA 338; FINA 363; FINA 367; FINA 375; FINA 382; FINA 401; FINA 450  

ACTS 441 Introduction to Financial Economics  
Crosslisted with: ACTS 841  
Prerequisites: MATH 208 with grade of "C" or better or concurrent; ACTS 440  
Description: Financial mathematics concepts related to short sales, forwards, options, futures, and swaps, and their use in risk management, hedging and investment strategies, fundamental concepts of put-call parity and no-arbitrage, and interest rate models.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Grading Option: Graded  

ACTS 442 Principles of Pension Valuation  
Crosslisted with: ACTS 842  
Prerequisites: ACTS 471/871 with a grade of "C" or better  
Description: Actuarial cost methods. Determination of normal costs and accrued liability. Effect on valuation results due to changes in experience, assumptions and plan provisions. Valuation of ancillary benefits. Determination of actuarially equivalent benefits at early or postponed retirement and optional forms of payment.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Grading Option: Graded  

ACTS 450 Stochastic Processes for Actuaries  
Crosslisted with: ACTS 850  
Prerequisites: STAT 463 with a grade of "C" or better  
Description: Introduction to stochastic processes and their applications in actuarial science. Discrete-time and continuous-time processes; Markov chains; the Poisson process; compound Poisson processes; non-homogeneous Poisson processes; arithmetic and geometric Brownian motions. Applications of these processes in computation of resident fees for continuing care retirement communities. Pricing of financial instruments.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Grading Option: Graded  

ACTS 470 Life Contingencies I  
Crosslisted with: ACTS 870  
Prerequisites: ACTS 440 and STAT 462, each with a grade of "C" or better  
Notes: First course of a two-course sequence that includes ACTS 471.  
Description: Probability and applications of contingency mathematics in the areas of life and health insurance, annuities, and pensions. Probabilistic models.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Grading Option: Graded  
Prerequisite for: ACTS 403  

ACTS 471 Life Contingencies II  
Crosslisted with: ACTS 871  
Prerequisites: ACTS 470 and STAT 462, each with a grade of "C" or better  
Notes: Second course of a two-course sequence that includes ACTS 470.  
Description: Life insurance reserve for models based on a single life. Introduction to multiple life models for pensions and life insurance and to multiple decrement models.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Grading Option: Graded  
Prerequisite for: ACTS 403; ACTS 442, ACTS 842  

ACTS 473 Introduction to Risk Theory  
Crosslisted with: ACTS 873  
Prerequisites: STAT 462 with a grade of "C" or better  
Description: Applications of compound distributions in modeling of insurance loss. Continuous-time compound Poisson surplus processes, computation of ruin probabilities, the distributions of the deficit at the time of ruin, and the maximal aggregate loss. The effect of reinsurance on the probability of ruin.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Grading Option: Graded  
Prerequisite for: ACTS 403  

ACTS 474 Introduction to Property/Casualty Actuarial Science  
Crosslisted with: ACTS 874  
Prerequisites: STAT 462 with a grade of "C" or better  
Description: Mathematical, financial, and risk-theoretical foundations of casualty actuarial science. Risk theory, loss reserving, ratemaking, risk classification, credibility theory, reinsurance, financial pricing of insurance, and other special issues and applications.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Grading Option: Graded  

ACTS 475 Actuarial Applications in Practice  
Crosslisted with: ACTS 875  
Prerequisites: ACTS 471/871; FINA 307/307H or FINA 338  
Description: Principles and practices of pricing and/or funding and valuation for life, health, property and liability insurance, and annuities and pension plans. Commercially available actuarial modeling software.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Grading Option: Graded  
ACE: ACE 10 Integrated Product