ACTUARIAL SCIENCE (ACTS)

ACTS 399 Independent Study
Prerequisites: Permission.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
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". Determining equivalent measures of interest; estimating the rate of return on a fund; discounting or accumulating a sequence of payments with interest; determining yield rate; length of investment; amounts of investment contributions or amounts of investment returns for various types of financial transactions; and basic calculations involving yield curves, spot rates, forward rates, duration, convexity, immunization and short sales; introduction to financial derivatives (forwards, options, futures, and swaps) and their use in risk management; and introduction to the concept of no-arbitrage as a fundamental concept in financial mathematics.
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
Prerequisite for: ACTS 404

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
Prerequisite for: ACTS 404

ACTS 430 Actuarial Applications of Applied Statistics
Crosslisted with: ACTS 830
Prerequisites: STAT 463 with a grade of "C" or better
Notes: Data sets processed and analyzed using statistical software.
Description: 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
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Crosslisted with</th>
<th>Prerequisites</th>
<th>Description</th>
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<th>Credit Hours</th>
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<tbody>
<tr>
<td>ACTS 440</td>
<td>Interest Theory</td>
<td>ACTS 840</td>
<td>MATH 208 or 208H with a grade of &quot;Pass&quot; or &quot;C&quot; or better, or parallel</td>
<td>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.</td>
<td>Grade only</td>
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<td>ACTS 441</td>
<td>Introduction to Financial Economics</td>
<td>ACTS 841</td>
<td>MATH 208 with grade of &quot;C&quot; or better or concurrent; ACTS 440</td>
<td>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.</td>
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<td>ACTS 442</td>
<td>Principles of Pension Valuation</td>
<td>ACTS 842</td>
<td>ACTS 471/871 with a grade of &quot;C&quot; or better</td>
<td>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.</td>
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<td>ACTS 450</td>
<td>Stochastic Processes for Actuaries</td>
<td>ACTS 850</td>
<td>STAT 463 with a grade of &quot;C&quot; or better</td>
<td>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.</td>
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<td>ACTS 470</td>
<td>Life Contingencies I</td>
<td>ACTS 870</td>
<td>ACTS 440 and STAT 462, each with a grade of &quot;C&quot; or better</td>
<td>First course of a two-course sequence that includes ACTS 471. Theory and applications of contingency mathematics in the areas of life and health insurance, annuities, and pensions. Probabilistic models.</td>
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<td>ACTS 471</td>
<td>Life Contingencies II</td>
<td>ACTS 871</td>
<td>ACTS 470 and STAT 462, each with a grade of &quot;C&quot; or better</td>
<td>Second course of a two-course sequence that includes ACTS 470. Introduction to multiple life models for pensions and life insurance and to multiple decrement models.</td>
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<td>ACTS 473</td>
<td>Introduction to Risk Theory</td>
<td>ACTS 873</td>
<td>STAT 462 with a grade of &quot;C&quot; or better</td>
<td>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.</td>
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<td>ACTS 474</td>
<td>Introduction to Property/Casualty Actuarial Science</td>
<td>ACTS 874</td>
<td>STAT 462 with a grade of &quot;C&quot; or better</td>
<td>Mathematical, financial, and risk-theoretical foundations of casualty actuarial science. Risk theory, loss reserving, ratemaking, risk classification, credibility theory, reinsurace, financial pricing of insurance, and other special issues and applications.</td>
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<td>ACTS 475</td>
<td>Actuarial Applications in Practice</td>
<td>ACTS 875</td>
<td>ACTS 471/871; FINA 307/307H or FINA 338</td>
<td>Principles and practices of pricing and/or funding and valuation for life, health, property and liability insurance, annuities and pension plans. Commercially available actuarial modeling software.</td>
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ACE: ACE 10 Integrated Product