

## Course Information

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Check the University Bulletin for listed courses in the Department of Mathematical Sciences.

Check the [Course Schedules](#) in the Department of Mathematical Sciences.

Here is a summary of all related courses and their status. When you plan your schedule, pay attention to those courses that are not offered every semester.

Course No.	Course name	Semester	Required/ recommended	Prerequisites
224/225	Calculus I	every	BA and BS	none
226/227	Calculus II	every	BA and BS	225
230	Honors Calculus	every	BA and BS (alternative to 226/227)	225
304	Linear Algebra	every	BA and BS	225
323	Calculus III	every	BA and BS	227 or 230
330	Number Systems	every	BA and BS	227 or 230
346	Intro. to Financial Mathematics	every	BA and BS	227 or 230
404	Advanced Linear Algebra	spring only	elective	304 and 330
447	Probability Theory	every	BA and BS	323
448	Mathematical Statistics	every	BA and BS	330 and 447
450	Long-term Actuarial Math I	fall only	elective	330, 346, and 447
452	Long-term Actuarial Math II	every other spring	elective	304 and 450
454	Financial Mathematics	occasional	elective	346 and 447
455	Intro. to Regression Models	spring only	elective	329 and 448
457	Intro. to Statistical Learning	fall only	elective	329 and 448
458	Time Series	every other spring	elective	448
472	PDE and Mathematical Analysis	spring only	elective	323, 330 and one of 324, 371, or 372
478	Real Analysis I	fall only	elective	304, 323, and 330
479	Real Analysis II	spring only	elective	478
Econ 160	Principles of Microeconomics	every	BA and BS	none
Econ 162	Principles of Macroeconomics	every	BA and BS	none
Econ 360	Microeconomic Theory	every	BS	Econ 160, 220 or 221
Econ 362	Macroeconomic Theory	every	BS	Econ 162
Econ 467	Economic Forecasting	every	elective (alternative to 458)	ECON 362, 366 and 466, MATH 220 or 224/225
Fin 311	Financial Management	every	No required. May be helpful.	Junior Standing and Acct 211, Econ 160 and 162, Math 220 or 224/225
Fin 322	Investments	every	No required. May be helpful.	
Fin 324	Corporate Finance	every	No required. May be helpful.	

## Calculus

Calculus is a branch of mathematics that studies continuously changing quantities. A key notion is the passage to the limit: quantities that tend to ultimate values. The basic tools from calculus are differentiation and integration. The methods of calculus are essential to any modern science. Department of Mathematical Sciences offers the following courses in calculus:

- Math 224/225. Calculus I.
- Math 226/227. Calculus II.
- Math 230. Honors Calculus. Directed at students who already have credit for calculus 1 or even calculus 2 and a strong record of performance in mathematics (like a high score on the calculus AP exam). It is appropriate for strong and mathematically curious students ready to work hard. It can be taken instead of Math 226/227
- Math 323. Calculus III.

## Probability and Statistics

Many problems which an actuary has to deal with are contingent/uncertain events. Probability theory is the branch of mathematics that studies the assignment of probabilities to random events. Department of Mathematical Sciences offers the following courses in Probability:

- Math 447. Probability Theory: Counting techniques, independence and conditional probability, discrete and continuous random variables, special distributions, expected values and moments, multivariate distributions, conditional distributions, transformations of random variables, limit theorems. 4 credits. Offered both in Fall and Spring.

Another part of mathematics studying randomness is Statistics. Statistics studies the collection and analysis of data. Department of Mathematical Sciences offers the following courses in Statistics:

- Math 448. Mathematical Statistics: Random sampling, point estimation, t, chi-squared, and F distributions, sufficient statistics, minimum variance unbiased estimators, confidence intervals, tests of hypothesis, uniformly most powerful tests, Bayesian methods, linear models. 4 credits. Offered both in Fall and Spring.
- Math 455. Introduction to Regression Models. This course covers the mathematical foundation and practical implementations of linear and generalized linear regression models. Topics include estimation and diagnostics of linear models, transformations of variables, model selection, polynomial regression, and logistic regression. The emphasis of the course will be on applications. 4 credits. Offered in Spring only.
- Math 457. Intro to Statistical Learning. Statistical learning refers to a set of tools for modeling and understanding complex datasets. This course covers such topics as regression, classification, resampling, model selection, regularization, tree-based methods, support vector machine, principal components analysis, and clustering methods. It concentrates more on the applications of the methods and provides students with valuable hands-on experience. 4 credits. Offered in Fall only.
- Math 458. Time Series: The statistical analysis of time series data. Autocorrelation; stationarity, basic time series models; AR, MA, ARMA; trend removal and seasonal adjustment; invertibility; spectral analysis; estimation; forecasting; introduction to financial time series and the ARCH model.

These courses fulfill the *Applied Statistics* subject and the *Mathematical Statistics* subject of the VEE requirements. Please see the [VEE](#) requirements for more information. These courses also cover partially the syllabi for CAS: Statistics and Probabilistic Models Exam, Construction and Evaluation of Actuarial Models Exam, Statistics for Risk Modeling Exam, and Predictive Analytics.

## Financial Mathematics

Department of Mathematical Sciences offers the following courses in Financial Mathematics:

- Math 346. Introduction to Financial Mathematics: Accumulation function, simple and compounded interest, effective and nominal rates of interest and discount, the force of interest, level and nonlevel annuities and perpetuities, amortization, reinvestment, sinking funds, bonds, depreciation methods, short sales of stock, term structure of the interest rates, duration, convexity, derivative markets. The material will focus on the requirements for the Exam FM/2. 4 credits. Offered both in Fall and Spring.
- Math 454. Financial Mathematics: Interest rate models, the principle of no-arbitrage, fundamental theorem of asset pricing, evaluation of derivatives, put-call parity, European put and call options, binomial models, Black-Scholes option-pricing model, American options, option Greeks, exotic options, lognormal distribution, diffusion process, Ito's lemma, simulation, and delta-hedging. The material will focus on the requirements for the Exam MFE. 4 credits. Math 346 and Math 447 are prerequisites of this course.

## Actuarial Mathematics

Actuaries use sophisticated probability models. Department of Mathematical Sciences offers the following courses in actuarial stochastic models:

- Math 450. Life Contingency Models I: Survival models, life tables, life insurance, life annuities, benefit premiums. 4 credits. Offered each Fall.
- Math 452. Life Contingency Models II: Benefit reserves, multiple life functions, multiple decrement models, Markov chains, Poisson processes. 4 credits. Offered in Spring. Availability depends on enrollment.

## Economics and Finance

An actuary studies contingent / uncertain events which have financial consequences. Hence he/she must have a good knowledge of Economics and Finance. In addition, VEE requirements include microeconomics, macroeconomics, and corporate finance. The following courses deal with microeconomics and macroeconomics. They fulfill the VEE requirements on the *Economics* subject:

- ECON 160. Principles of Microeconomics.
- ECON 162. Principles of Macroeconomics.
- ECON 360. Microeconomic Theory.
- ECON 362. Macroeconomic Theory.

So far, to fulfill the VEE requirements on the *Finance* subject, students must take courses from the school of management (SOM):

- FIN 311, Financial Management.
- FIN 322, Investments.
- FIN 324, Corporate Finance.

FIN 311 is open for registration for Harpur students in the Financial Economics major and the Actuarial major. FIN 322 or FIN 324 is not yet open for registration for students out of SOM. Please seek help from your advisor should you want to register for FIN 322 or FIN 324.

## Other courses

Other related courses are ECON 466. Introduction to Econometrics; ECON 467. Economic Forecasting; CQS 112. Statistics for Management; ECON 442, Financial Economics.

For computing skills, students can take CS 105, which provides some help on spreadsheets such as Excel, and CS 110, which introduces students to programming using python as the language.

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