APPLIED MATHEMATICS (BS)

Program Requirements

Code	Title	Hours
Lower Division		
MATH 157	Calculus and Analytic Geometry I	4
MATH 258	Calculus and Analytic Geometry II	4
MATH 259	Calculus and Analytic Geometry III	4
MATH 260	Ordinary Differential Equation [1]	3
CPSC 121	Computer Science I	3
Upper Division		
MATH 301	Fundamentals of Mathematics	3
MATH 335	Applied Linear Algebra	3
or MATH 339	Linear Algebra	
MATH 350	Numerical Methods [2]	3
MATH 413	Real Analysis I [3]	3
Select one of the following:		3
MATH 321	Statistics for Experimentalist [4]	
MATH 422	Mathematical Statistics [5]	
MATH 496	Comprehensive for Applied Mathematics	1
Select an Applied Math concentration option [6]		23-43
Total Hours		**57-77**

[1] Computer Science concentration only: MATH 260 Ordinary Differential Equation optional, may be counted as a MATH 300-400 level elective.

[2] Actuarial Science Concentration students take MATH 423 Stochastic Processes instead of MATH 350 Numerical Methods.

[3] Computer Science concentration students may choose MATH 437 Abstract Algebra I, or MATH 457 Number Theory and Cryptography instead of MATH 413 Real Analysis I.

[4] Actuarial Science concentration students must take MATH 422 Mathematical Statistics (not MATH 321 Statistics for Experimentalist).

[5] All non-double concentrations except Actuarial Science: If MATH 422 Mathematical Statistics is chosen, then one MATH 400-level elective may be replaced by a MATH 300-level elective.

[6] Due to the interdisciplinary nature of the following options, students should make note of prerequisites and minimum grade requirements that may not be listed as degree.

Applied Math Concentration Options

(Due to the interdisciplinary nature of the following options, students should make note of pre-requisites and minimum grade requirements that may not be listed as degree requirements.)

No concentration 23-24 credits
Actuarial Science concentration   35 credits
Biology concentration 34 credits
Biochemistry concentration 33 credits
Chemistry concentration 33 credits
Computer Science concentration 33 credits
Economics concentration 30-31 creds
Environmental Science concentration 34 credits
Physics concentration 31 credits
Statistics concentration 31-32 creds
Biology and Statistics double concentration 43 credits
Biochemistry and Statistics double concentration 42 credits
Chemistry and Statistics double concentration 42 credits
Economics and Statistics double concentration 39-40 creds
Environmental Science and Statistics double concentration 43 credits
Physics and Statistics double concentration 40 credits

Note Math Electives:

- Cannot double-count with a required course.
- Cannot use MATH 335 Applied Linear Algebra, MATH 339 Linear Algebra, MATH 432 CIS: or MATH 499 Comprehensive for Mathematics as MATH electives.
- Maximum of three (3) total credits from the following may be counted toward Math electives: MATH 365 Math Seminar (may be taken for credit only once), MATH 390 Directed Study, MATH 490 Directed Reading, MATH 497 Mathematics Internship.

No Concentration

34 credits + 23-24 credits
57-58 credits

Code	Title	Hours
Select two of the following three courses/lab combinations:		8
BIOL 105 & 105L	Information Flow in Biological Systems and Information Flow in Biological Systems Lab	
CHEM 101 & 101L	General Chemistry I and General Chemistry I Lab	
PHYS 121	Physics I	
Select one of the following:		3-4
BIOL 106	Energy Flow in Biological Systems	
CHEM 205	Inorganic Chemistry	
CHEM 230 & 230L	Organic Chemistry I and Organic Chemistry Lab I	
PHYS 122	Physics II	
Select one of the following:		3
MATH 440	Foundations of Applied Math	
MATH 454	Partial Differential Equations	
MATH 462	Nonlinear Systems and Chaos	
MATH 300-400 level elective		3
MATH 400-level electives		6
Total Hours		**23-24**

Math Electives:

- Cannot double-count with a required course.
- Cannot use MATH 335 Applied Linear Algebra, MATH 339 Linear Algebra, MATH 432 CIS: or MATH 499 Comprehensive for Mathematics as MATH electives.
- Maximum of three (3) total credits from the following may be counted toward Math electives: MATH 365 Math Seminar (may be taken for credit only once), MATH 390 Directed Study, MATH 490 Directed Reading, MATH 497 Mathematics Internship.

Applied Math Single Concentrations
Actuarial Science Concentration

34 credits + 35 credits
69 credits

Code	Title	Hours
ACCT 263	Accounting Analysis	3
ECON 201	Microeconomics	3
ECON 202	Macroeconomics	3
ECON 301	Intermediate Microeconomics	3
ECON 352	Money and Banking	3
ECON 352L	Money and Banking Math Lab	1
ECON 355	Regression Analysis	3
ECON 451	Econometrics	3
MATH 421	Probability Theory	3
MATH 494	Topics in Actuarial Science	1
MATH 300-400 electives		6
Select one of the following:		3
MATH 400-level elective		
ECON 452	Time Series Analysis	
Total Hours		**35**

Math Electives:

- Cannot double-count with a required course.
- Cannot use MATH 335 Applied Linear Algebra, MATH 339 Linear Algebra, MATH 432 CIS: or MATH 499 Comprehensive for Mathematics as MATH electives.
- Maximum of three (3) total credits from the following may be counted toward Math electives: MATH 365 Math Seminar (may be taken for credit only once), MATH 390 Directed Study, MATH 490 Directed Reading, MATH 497 Mathematics Internship.

Biology Concentration

34 credits + 34 credits
68 credits

Code	Title	Hours
CHEM 101 & 101L	General Chemistry I and General Chemistry I Lab	4
BIOL 105 & 105L	Information Flow in Biological Systems and Information Flow in Biological Systems Lab	4
BIOL 106	Energy Flow in Biological Systems	3
Select two of the following:		8
BIOL 205 & 205L	Physiology and Biodiversity and Physiology and Biodiversity Lab	
BIOL 206 & 206L	Ecology and Ecology Lab	
BIOL 207 & 207L	Genetics and Genetics Lab	
BIOL 300-400 level electives		6
Select one of the following:		3
MATH 440	Foundations of Applied Math	
MATH 454	Partial Differential Equations	
MATH 462	Nonlinear Systems and Chaos	
MATH 400-level electives		6
Total Hours		**34**

Biology elective options:

Code	Title	Hours
BIOL 303	Population Ecology	3
BIOL 313	Animal Behavior	3
BIOL 323	Conservation Biology	3
BIOL 331	Parasitology	3
BIOL 333	Community Ecology	3
BIOL 335	Advanced Genetics:	3
BIOL 340	Field Botany	3
BIOL 341	Human Physiology	3
BIOL 343	Plant Community Ecology	3
BIOL 344	Introduction to GIS in Biology	3
BIOL 357	Principles of Wildlife Management	3
BIOL 360	Plant Biology	3
BIOL 367	Entomology	3
BIOL 371	Vertebrate Biology and Anatomy	3
BIOL 399	Advanced Topic:	2
BIOL 403	Marine Biology	3
BIOL 420	Physiological Ecology	3
BIOL 441	Advanced Physiology	3

Other courses may be considered on a case-by-case basis). BIOL 334 Advanced Evolution, BIOL 337 Developmental Biology, and BIOL 451 Comparative Endocrinology are allowed but require BIOL 205 Physiology and Biodiversity, BIOL 206 Ecology, and BIOL 207 Genetics as prerequisites. Up to 2 credits may come from labs associated with any of these courses.

Math Electives:

- Cannot double-count with a required course.
- Cannot use MATH 335 Applied Linear Algebra, MATH 339 Linear Algebra, MATH 432 CIS: or MATH 499 Comprehensive for Mathematics as MATH electives.
- Maximum of three (3) total credits from the following may be counted toward Math electives: MATH 365 Math Seminar (may be taken for credit only once), MATH 390 Directed Study, MATH 490 Directed Reading, MATH 497 Mathematics Internship.

Biochemistry Concentration

34 credits + 32 credits
67credits

Code	Title	Hours
CHEM 101 & 101L	General Chemistry I and General Chemistry I Lab	4
CHEM 230 & 230L	Organic Chemistry I and Organic Chemistry Lab I	4
CHEM 231 & 231L	Organic Chemistry II and Organic Chemistry Lab II	4
CHEM 245 & 245L	Biochemistry and Biochemistry Lab	4
CHEM 399	Advanced Topics:	2
CHEM 407	Special Topics in Biochemistry	2
Select one of the following:		3
MATH 440	Foundations of Applied Math	
MATH 454	Partial Differential Equations	
MATH 462	Nonlinear Systems and Chaos	

MATH 300-400 level elective		3
MATH 400-level electives		6
Total Hours		**32**

Math Electives:

- Cannot double-count with a required course.
- Cannot use MATH 335 Applied Linear Algebra, MATH 339 Linear Algebra, MATH 432 CIS: or MATH 499 Comprehensive for Mathematics as MATH electives.
- Maximum of three (3) total credits from the following may be counted toward Math electives: MATH 365 Math Seminar (may be taken for credit only once), MATH 390 Directed Study, MATH 490 Directed Reading, MATH 497 Mathematics Internship.

Chemistry Concentration

34 credits + 33 credits
67 credits

Code	Title	Hours
PHYS 121	Physics I	4
CHEM 101 & 101L	General Chemistry I and General Chemistry I Lab	4
CHEM 205	Inorganic Chemistry	3
CHEM 230 & 230L	Organic Chemistry I and Organic Chemistry Lab I	4
CHEM 310 & 310L	Analytical Chemistry and Analytical Chemistry Lab	5
CHEM 355	Physical Chemistry	3
Select one of the following:		3
MATH 440	Foundations of Applied Math	
MATH 454	Partial Differential Equations	
MATH 462	Nonlinear Systems and Chaos	
MATH 400-level electives		6
Total Hours		**32**

Math Electives:

- Cannot double-count with a required course.
- Cannot use MATH 335 Applied Linear Algebra, MATH 339 Linear Algebra, MATH 432 CIS: or MATH 499 Comprehensive for Mathematics as MATH electives.
- Maximum of three (3) total credits from the following may be counted toward Math electives: MATH 365 Math Seminar (may be taken for credit only once), MATH 390 Directed Study, MATH 490 Directed Reading, MATH 497 Mathematics Internship.

Computer Science Concentration

31 credits + 33 credits
64 credits

Code	Title	Hours
CPSC 122	Computer Science II	3
or CPSC 222	Introduction to Data Science	
Select one of the following:		3
CPSC 322	Data Science Algorithms	
CPSC 351	Theory of Computation	
CPSC 353	Applied Cryptography	

Code	Title	Hours
CPSC 450	Design and Analysis of Computer Algorithms	
CPSC 200-300-400 level electives		3
CPSC 300-400 level electives		3
MATH 351	Combinatorics and Graph Theory	3
Select three of the following:		9
MATH 328	Operations Research	
MATH 421	Probability Theory	
MATH 423	Stochastic Processes	
MATH 425	Applied Statistical Models	
MATH 426	Experimental Design	
MATH 455	Chaos and Discrete Dynamical Systems	
MATH 300-400 elective		3
MATH 400-level electives		6
Total Hours		**33**

CPSC elective options:

Code	Title	Hours
CPSC 224	Software Development	3
CPSC 321	Database Management Systems	3
CPSC 322	Data Science Algorithms [1]	3
CPSC 323	Machine Learning and Intelligent Systems [1]	3
CPSC 325	Data Science Project Lab	3
CPSC 326	Organization of Program Languages	3
CPSC 331	UI/UX Design	3
CPSC 328	Computer Networks	3
CPSC 332	Web Development	3
CPSC 333	Mobile App Development	3
CPSC 334	Linux and DevOps	3
CPSC 351	Theory of Computation [1]	3
CPSC 353	Applied Cryptography [1]	3
CPSC 475	Speech and Natural Language Processing	3

Other options are CPSC 223 Algorithm and Abstract Data Structures, CPSC 425 Computer Graphics, CPSC 450 Design and Analysis of Computer Algorithms[1] (check for prerequisites).

[1] Recommended elective choices

Math Electives:

- Cannot double-count with a required course.
- Cannot use MATH 335 Applied Linear Algebra, MATH 339 Linear Algebra, MATH 432 CIS: or MATH 499 Comprehensive for Mathematics as MATH electives.
- Maximum of three (3) total credits from the following may be counted toward Math electives: MATH 365 Math Seminar (may be taken for credit only once), MATH 390 Directed Study, MATH 490 Directed Reading, MATH 497 Mathematics Internship.

Economics Concentration

(34 credits + 30-31 credits)
64-65 credits

Code	Title	Hours
ECON 201	Microeconomics	3
ECON 202	Macroeconomics	3
ECON 301	Intermediate Microeconomics [1]	3
or ECON 351	Managerial Economics	
ECON 303	Game Theory and Economic Applications	3
ECON 300-400 level elective		3-4
MATH 421	Probability Theory	3
Select two of the following:		6
MATH 423	Stochastic Processes	
MATH 425	Applied Statistical Models	
MATH 426	Experimental Design	
MATH 440	Foundations of Applied Math	
MATH 454	Partial Differential Equations	
MATH 300-400 level elective		3
MATH 400-level elective		3
Total Hours		**30-31**

[1] ECON 301 Intermediate Microeconomics prerequisite ECON 201 Microeconomics requires a minimum grade of B-.

ECON Elective options:

Code	Title	Hours
ECON 320	Economics of Sports	3
ECON 321	International Economics [1]	3
ECON 322	Work, Wages, and Inequality	3
ECON 324	Economics of Environmental Protection	3
ECON 325	Public Finance	3
ECON 330	Antitrust Policy and Regulation	3
ECON 333	Health Economics	3
ECON 334	Behavioral Economics	3
ECON 352 & 352L	Money and Banking and Money and Banking Math Lab [1]	4
ECON 355	Regression Analysis	3
ECON 451	Econometrics [1]	3
ECON 452	Time Series Analysis [1]	3

[1] Recommended elective choices

Math Electives:

- Cannot double-count with a required course.
- Cannot use MATH 335 Applied Linear Algebra, MATH 339 Linear Algebra, MATH 432 CIS: or MATH 499 Comprehensive for Mathematics as MATH electives.
- Maximum of three (3) total credits from the following may be counted toward Math electives: MATH 365 Math Seminar (may be taken for credit only once), MATH 390 Directed Study, MATH 490 Directed Reading, MATH 497 Mathematics Internship.

Environmental Science Concentration

34 credits + 34 credits
68 credits

Code	Title	Hours
ENVS 101	Introduction to Environmental Studies	3
ENVS 103 & 103L	Environmental Biology and Environmental Biology Lab [1]	4
Select one of the following:		4
BIOL 105 & 105L	Information Flow in Biological Systems and Information Flow in Biological Systems Lab	
CHEM 101 & 101L	General Chemistry I and General Chemistry I Lab	
Select one of the following:		4
ENVS 110 & 110L	Earth Science and Earth Science Lab	
ENVS 202 & 202L	Applied Environmental Chemstry and Applied Environmental Chemistry Lab [2]	
ENVS 320	Econ of Environmental Protectn [3]	3
ENVS 384	Introduction to GIS in Biology [4]	3
Select two of the following:		6
MATH 425	Applied Statistical Models	
MATH 426	Experimental Design	
MATH 440	Foundations of Applied Math	
MATH 454	Partial Differential Equations	
MATH 462	Nonlinear Systems and Chaos	
MATH 300-400 level elective		3
MATH 400-level elective		3
Total Hours		**33**

[1] Alternative: BIOL 206 Ecology/BIOL 206L Ecology Lab (cross-listed, prerequisite BIOL 105 Information Flow in Biological Systems/BIOL 106 Energy Flow in Biological Systems) with a C- or better.

[2] Prerequisite CHEM 101 General Chemistry I/CHEM 101L General Chemistry I Lab.

[3] Alternative: ECON 324 Economics of Environmental Protection (prerequisite ECON 200 Economic Analysis or ECON 201 Microeconomics).

[4] Alternative: BIOL 344 Introduction to GIS in Biology (cross-listed, prerequisite BIOL 106 Energy Flow in Biological Systems/BIOL 206 Ecology).

Math Electives:

- Cannot double-count with a required course.
- Cannot use MATH 335 Applied Linear Algebra, MATH 339 Linear Algebra, MATH 432 CIS: or MATH 499 Comprehensive for Mathematics as MATH electives.
- Maximum of three (3) total credits from the following may be counted toward Math electives: MATH 365 Math Seminar (may be taken for credit only once), MATH 390 Directed Study, MATH 490 Directed Reading, MATH 497 Mathematics Internship.

Physics Concentration

34 credits + 31 credits
65 credits

Code	Title	Hours
PHYS 121 & 121L	Physics I and Physics I Lab	5

PHYS 122 & 122L	Physics II and Physics II Lab	5
PHYS 200, 300, 400 level electives		6
Select two of the following:		6
MATH 417	Complex Variables	
MATH 440	Foundations of Applied Math	
MATH 454	Partial Differential Equations	
MATH 462	Nonlinear Systems and Chaos	
MATH 300-400 level elective		3
MATH 400-level electives		6
Total Hours		**31**

PHYS elective options:

Code	Title	Hours
PHYS 224	Modern Physics	3
PHYS 321	Classical Mechanics	3
PHYS 322	Electricity and Magnetism	3
PHYS 323	Statistical Mechanics	3
PHYS 324	Quantum Mechanics [1]	3
PHYS 424	Advanced Quantum Mechanics	3
PHYS 451	Fields, Oscs, and Relativity	3
PHYS 452	Optics	3
PHYS 454	Nuclear and Particle Physics [1]	3
PHYS 455	Cosmology and Astrophysics	3
PHYS 456	Biophysical Systems and Modeling	3

[1] Require PHYS 224 Modern Physics, PHYS 321 Classical Mechanics, and PHYS 322 Electricity and Magnetism as prerequisites; PHYS 424 Advanced Quantum Mechanics requires PHYS 324 Quantum Mechanics as prerequisite

Math Electives:

- Cannot double-count with a required course.
- Cannot use MATH 335 Applied Linear Algebra, MATH 339 Linear Algebra, MATH 432 CIS: or MATH 499 Comprehensive for Mathematics as MATH electives.
- Maximum of three (3) total credits from the following may be counted toward Math electives: MATH 365 Math Seminar (may be taken for credit only once), MATH 390 Directed Study, MATH 490 Directed Reading, MATH 497 Mathematics Internship.

Statistics Concentration

34 credits + 31-32 credits
65-66 credits

Code	Title	Hours
Select one of the following three sets of courses:		7-8
Biology Set:		
BIOL 105 & 105L	Information Flow in Biological Systems and Information Flow in Biological Systems Lab	
BIOL 106	Energy Flow in Biological Systems	
Physics Set:		
PHYS 121	Physics I	
PHYS 122	Physics II	

Code	Title	Hours
Chemistry Set:		
CHEM 101 & 101L	General Chemistry I and General Chemistry I Lab	
CHEM 205	Inorganic Chemistry	
Select one of the following:		3
MATH 440	Foundations of Applied Math	
MATH 454	Partial Differential Equations	
MATH 462	Nonlinear Systems and Chaos	
MATH 421	Probability Theory	3
MATH 425 or MATH 426	Applied Statistical Models Experimental Design	3
MATH 300-400 level elective		3
MATH 400-level electives		6
Select two courses from the Statistics Electives List [1]		6
Total Hours		**31-32**

[1] One course must be MATH. Cannot double-count with courses used elsewhere.

Statistics Electives List

Code	Title	Hours
MATH 422	Mathematical Statistics	3
MATH 423	Stochastic Processes	3
MATH 426	Experimental Design	3
ECON 355	Regression Analysis	3
ECON 451	Econometrics	3
ECON 452	Time Series Analysis	3
CPSC 322	Data Science Algorithms	3
CPSC 323	Machine Learning and Intelligent Systems	3
PHYS 323	Statistical Mechanics	3
PSYC 450	Advanced Statistics in Psychology	3

Or any course with significant probability or statistics content with approval of the Math Department Chair. All of these courses have pre-requisites and may require courses outside of the concentration to be taken.

Math Electives:

- Cannot double-count with a required course.
- Cannot use MATH 335 Applied Linear Algebra, MATH 339 Linear Algebra, MATH 432 CIS: or MATH 499 Comprehensive for Mathematics as MATH electives.
- Maximum of three (3) total credits from the following may be counted toward Math electives: MATH 365 Math Seminar (may be taken for credit only once), MATH 390 Directed Study, MATH 490 Directed Reading, MATH 497 Mathematics Internship.

Applied Math Double Concentrations
Biology and Statistics Double Concentration

34 credits + 41 credits
75 credits

Students complete the B.S. Major in Applied Mathematics with a Biology concentration as listed above, with the following difference for MATH electives:

- Three credits of MATH 400-level electives instead of six credits.
- Students take additional statistic courses.

Code	Title	Hours
MATH 300-400 level elective		3
MATH 421	Probability Theory	3
MATH 425	Applied Statistical Models	6
or MATH 426	Experimental Design	
Select two courses from the Statistics Electives list [1]		6
Total Hours		**18**

[1] One course must be MATH. Cannot double-count with courses used elsewhere.

Statistics Electives List

Code	Title	Hours
MATH 422	Mathematical Statistics	3
MATH 423	Stochastic Processes	3
MATH 426	Experimental Design	3
ECON 355	Regression Analysis	3
ECON 451	Econometrics	3
ECON 452	Time Series Analysis	3
CPSC 322	Data Science Algorithms	3
CPSC 323	Machine Learning and Intelligent Systems	3
CPSC 324		3
PHYS 323	Statistical Mechanics	3
PSYC 450	Advanced Statistics in Psychology	3

Or any course with significant probability or statistics content with approval of the Math Department Chair. All of these courses have pre-requisites and may require courses outside of the concentration to be taken.

Math Electives:

- Cannot double-count with a required course.
- Cannot use MATH 335 Applied Linear Algebra, MATH 339 Linear Algebra, MATH 432 CIS: or MATH 499 Comprehensive for Mathematics as MATH electives.
- Maximum of three (3) total credits from the following may be counted toward Math electives: MATH 365 Math Seminar (may be taken for credit only once), MATH 390 Directed Study, MATH 490 Directed Reading, MATH 497 Mathematics Internship.

Biochemistry and Statistics Double Concentration

34 credits + 41 credits
75 credits

Students complete the B.S. Major in Applied Mathematics with a Biochemistry concentration as listed above, with additional statistics courses.

- Math electives differ with three credits instead of six credits for Math 400-level electives.

Code	Title	Hours
MATH 300-400 level electives		3
MATH 400-level elective		3

Code	Title	Hours
MATH 421	Probability Theory	3
MATH 425	Applied Statistical Models	3
or MATH 426	Experimental Design	
Select two courses from the Statistics Electives list [1]		6
Total Hours		**18**

[1] One course must be MATH. Cannot double-count with courses used elsewhere.

Statistics Electives List

Code	Title	Hours
MATH 422	Mathematical Statistics	3
MATH 423	Stochastic Processes	3
MATH 426	Experimental Design	3
ECON 355	Regression Analysis	3
ECON 451	Econometrics	3
ECON 452	Time Series Analysis	3
CPSC 322	Data Science Algorithms	3
CPSC 323	Machine Learning and Intelligent Systems	3
CPSC 324		3
PHYS 323	Statistical Mechanics	3
PSYC 450	Advanced Statistics in Psychology	3

Or any course with significant probability or statistics content with approval of the Math Department Chair. All of these courses have pre-requisites and may require courses outside of the concentration to be taken.

Math Electives:

- Cannot double-count with a required course.
- Cannot use MATH 335 Applied Linear Algebra, MATH 432 CIS: or MATH 496 Comprehensive for Applied Mathematics as MATH electives.
- Maximum of three (3) total credits from the following may be counted toward Math electives: MATH 365 Math Seminar (may be taken for credit only once), MATH 390 Directed Study, MATH 490 Directed Reading, MATH 497 Mathematics Internship.

Chemistry and Statistics Double Concentration

34 credits + 42 credits
76 credits

Students complete the B.S. Major in Applied Mathematics with a Chemistry concentration as listed above, with additional statistics courses.

- Three credits of MATH 300-400 electives instead of MATH 400-level electives
- Students take additional statistics courses.

Code	Title	Hours
MATH 300-400 level elective		3
MATH 421	Probability Theory	3
MATH 425	Applied Statistical Models	3
or MATH 426	Experimental Design	

Select two courses from the Statistics Electives list [1]		6
Total Hours		**15**

[1] One course must be MATH. Cannot double-count with courses used elsewhere.

Statistics Electives List

Code	Title	Hours
MATH 422	Mathematical Statistics	3
MATH 423	Stochastic Processes	3
MATH 426	Experimental Design	3
ECON 355	Regression Analysis	3
ECON 451	Econometrics	3
ECON 452	Time Series Analysis	3
CPSC 322	Data Science Algorithms	3
CPSC 323	Machine Learning and Intelligent Systems	3
CPSC 324		3
PHYS 323	Statistical Mechanics	3
PSYC 450	Advanced Statistics in Psychology	3

Or any course with significant probability or statistics content with approval of the Math Department Chair. All of these courses have pre-requisites and may require courses outside of the concentration to be taken.

Math Electives:

- Cannot double-count with a required course.
- Cannot use MATH 335 Applied Linear Algebra, MATH 339 Linear Algebra, MATH 432 CIS: or MATH 499 Comprehensive for Mathematics as MATH electives.
- Maximum of three (3) total credits from the following may be counted toward Math electives: MATH 365 Math Seminar (may be taken for credit only once), MATH 390 Directed Study, MATH 490 Directed Reading, MATH 497 Mathematics Internship.

Economics and Statistics Double Concentration

34 credits + 39-40 credits
73-74 credits

Students complete the B.S. Major in Applied Mathematics with an Economics concentration as listed above, with additional statistics courses.

The requirement to Choose two of the following five courses (MATH 423 Stochastic Processes, MATH 425 Applied Statistical Models, MATH 426 Experimental Design, MATH 440 Foundations of Applied Math, MATH 454 Partial Differential Equations) is modified as Choose one of two and Choose one of two courses as shown:

Code	Title	Hours
MATH 300-400 level elective		3
MATH 400-level elective		3
MATH 440	Foundations of Applied Math	3
or MATH 454	Partial Differential Equations	
MATH 425	Applied Statistical Models	3
or MATH 426	Experimental Design	

Select three courses from the Statistics Electives list [1]		9
Total Hours		**21**

[1] Two courses must be MATH. Cannot double-count with courses used elsewhere.

Statistics Electives List

Code	Title	Hours
MATH 422	Mathematical Statistics	3
MATH 423	Stochastic Processes	3
MATH 426	Experimental Design	3
ECON 355	Regression Analysis	3
ECON 451	Econometrics	3
ECON 452	Time Series Analysis	3
CPSC 322	Data Science Algorithms	3
CPSC 323	Machine Learning and Intelligent Systems	3
CPSC 324		3
PHYS 323	Statistical Mechanics	3
PSYC 450	Advanced Statistics in Psychology	3

Or any course with significant probability or statistics content with approval of the Math Department Chair. All of these courses have pre-requisites and may require courses outside of the concentration to be taken.

Math Electives:

- Cannot double-count with a required course.
- Cannot use MATH 335 Applied Linear Algebra, MATH 339 Linear Algebra, MATH 432 CIS: or MATH 499 Comprehensive for Mathematics as MATH electives.
- Maximum of three (3) total credits from the following may be counted toward Math electives: MATH 365 Math Seminar (may be taken for credit only once), MATH 390 Directed Study, MATH 490 Directed Reading, MATH 497 Mathematics Internship.

Environmental Science and Statistics Double Concentration

34 credits + 43 credits
77 credits

Students complete the B.S. Major in Applied Mathematics with a concentration in Environmental Science, plus additional statistics courses.

- The requirement to choose two of the following five courses (MATH 423 Stochastic Processes, MATH 425 Applied Statistical Models, MATH 426 Experimental Design, MATH 440 Foundations of Applied Math, MATH 454 Partial Differential Equations) is modified as choose one of three and choose one of two courses as shown.
- MATH 421 Probability Theory taken instead of MATH 400-level elective.

Code	Title	Hours
MATH 300-400 level elective		3
MATH 421	Probability Theory	3
Select one of the following:		3
MATH 440	Foundations of Applied Math	

MATH 454	Partial Differential Equations	
MATH 462	Nonlinear Systems and Chaos	
MATH 425	Applied Statistical Models	3
or MATH 426	Experimental Design	
Select three courses from the Statistics Electives list [1]		9
Total Hours		**21**

[1] Two courses must be MATH. Cannot double-count with courses used elsewhere.

Statistics Electives List

Code	Title	Hours
MATH 422	Mathematical Statistics	3
MATH 423	Stochastic Processes	3
MATH 426	Experimental Design	3
ECON 355	Regression Analysis	3
ECON 451	Econometrics	3
ECON 452	Time Series Analysis	3
CPSC 322	Data Science Algorithms	3
CPSC 323	Machine Learning and Intelligent Systems	3
CPSC 324		3
PHYS 323	Statistical Mechanics	3
PSYC 450	Advanced Statistics in Psychology	3

Or any course with significant probability or statistics content with approval of the Math Department Chair. All of these courses have pre-requisites and may require courses outside of the concentration to be taken.

Math Electives:

- Cannot double-count with a required course.
- Cannot use MATH 335 Applied Linear Algebra, MATH 339 Linear Algebra, MATH 432 CIS: or MATH 499 Comprehensive for Mathematics as MATH electives.
- Maximum of three (3) total credits from the following may be counted toward Math electives: MATH 365 Math Seminar (may be taken for credit only once), MATH 390 Directed Study, MATH 490 Directed Reading, MATH 497 Mathematics Internship.

Physics and Statistics Double Concentration

34 credits + 40 credits
74 credits

Students complete the B.S. Major in Applied Mathematics with a Physics concentration as listed above, with the following difference for MATH electives

- Three credits of MATH 400-level electives instead of six credits.
- Students take additional statistics courses

Code	Title	Hours
MATH 300-400 level elective		3
MATH 400-level elective		3
MATH 421	Probability Theory	3
MATH 425	Applied Statistical Models	3
or MATH 426	Experimental Design	

Select two courses from the Statistics Electives list [1]		6
Total Hours		**18**

[1] At least one course must be MATH. Cannot double-count with courses used elsewhere.

Statistics Electives List

Code	Title	Hours
MATH 422	Mathematical Statistics	3
MATH 423	Stochastic Processes	3
MATH 426	Experimental Design	3
ECON 355	Regression Analysis	3
ECON 451	Econometrics	3
ECON 452	Time Series Analysis	3
CPSC 322	Data Science Algorithms	3
CPSC 323	Machine Learning and Intelligent Systems	3
CPSC 324		3
PHYS 323	Statistical Mechanics	3
PSYC 450	Advanced Statistics in Psychology	3

Or any course with significant probability or statistics content with approval of the Math Department Chair. All of these courses have pre-requisites and may require courses outside of the concentration to be taken.

Math Electives:

- Cannot double-count with a required course.
- Cannot use MATH 335 Applied Linear Algebra, MATH 339 Linear Algebra, MATH 432 CIS: or MATH 499 Comprehensive for Mathematics as MATH electives.
- Maximum of three (3) total credits from the following may be counted toward Math electives: MATH 365 Math Seminar (may be taken for credit only once), MATH 390 Directed Study, MATH 490 Directed Reading, MATH 497 Mathematics Internship.

University Core

In addition to their major and minor areas of study, all undergraduate students follow a common program designed to complete their education in those areas that the University considers essential for a Catholic, Jesuit, liberal, and humanistic education. The University Core Curriculum consists of forty-five credits of course work, with additional designation requirements that can be met through core, major, or elective courses.

The University Core Curriculum is a four-year program, organized around one overarching question, which is progressively addressed through yearly themes and questions. Hence, core courses are best taken within the year for which they are designated. First year core courses encourage intellectual engagement and provide a broad foundation of fundamental skills. Second and third year courses examine central issues and questions in philosophy and religious studies. The fourth year course, the Core Integration Seminar, offers a culminating core experience. Taken at any time throughout the four years, broadening courses intersect with the core themes and extend students' appreciation for the humanities, arts, and social and behavioral sciences. Finally, the designation requirements (writing enriched, global studies, and social justice) reflect important values and reinforce students' knowledge and competencies.

Overarching Core Question: As students of a Catholic, Jesuit, and Humanistic University, how do we educate ourselves to become women and men for a more just and humane global community?

Year 1 Theme and Question: Understanding and Creating: How do we pursue knowledge and cultivate understanding?

- The First-Year Seminar (DEPT 193, 3 credits): The First-Year Seminar (FYS), taken in the fall or spring of the first year, is designed to promote an intellectual shift in students as they transition to college academic life. Each small seminar is organized around an engaging topic, which students explore from multiple perspectives. The FYS is offered by many departments across the University (click here [PDF] (https://www.gonzaga.edu/catalogs/current/undergraduate/school-of-engineering-and-applied-science/course-detail/?code=PHIL+101) for list of FYS courses).
- Writing (ENGL 101 Writing, 3 credits) and Reasoning (PHIL 101 Reasoning, 3 credits): The Writing and Reasoning courses are designed to help students develop the foundational skills of critical reading, thinking, analysis, and writing. They may be taken as linked sections. Writing (ENGL 101 Writing) carries one of the three required writing-enriched designations (see below).
- Communication & Speech (COMM 100 Communication and Speech, 3 credits): This course introduces students to interpersonal and small group communication and requires the application of critical thinking, reasoning, and research skills necessary to organize, write, and present several speeches.
- Scientific Inquiry (BIOL 104 Scientific Inquiry:/BIOL 104L Scientific Inquiry Lab, CHEM 104 Scientific Inquiry/CHEM 104L Scientific Inquiry Lab, or PHYS 104 Scientific Inquiry/, 3 credits): This course explores the scientific process in the natural world through evidence-based logic and includes significant laboratory experience. Students pursuing majors that require science courses will satisfy this requirement through their major.
- Mathematics (above Math 100, 3 credits): Mathematics courses promote thinking according to the modes of the discipline—abstractly, symbolically, logically, and computationally. One course in mathematics, above Math 100, excluding MATH 193 FYS: and including any math course required for a major or minor, will fulfill this requirement. MATH 100 College Algebra (College Algebra) and courses without the MATH prefix do not fulfill this requirement.

Year 2 Theme and Question: Being and Becoming: Who are we and what does it mean to be human?

- Philosophy of Human Nature (PHIL 201 Philosophy of Human Nature, 3 credits): This course provides students with a philosophical study of key figures, theories, and intellectual traditions that contribute to understanding the human condition; the meaning and dignity of human life; and the human relationship to ultimate reality.
- Christianity and Catholic Traditions (RELI, 3 credits). Religious Studies core courses approved for this requirement explore diverse topics including Christian scriptures, history, theology, and practices as well as major contributions from the Catholic intellectual and theological traditions (click here [PDF] (https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9E3A04EAD74) for a list of approved courses).

Year 3 Theme and Question: Caring and Doing: What principles characterize a well lived life?

- Ethics (PHIL 301 Ethics or RELI, 3 credits): The Ethics courses are designed to help students develop their moral imagination by exploring and explaining the reasons humans should care about the needs and interests of others. This requirement is satisfied by an approved ethics course in either Philosophy (PHIL 301 Ethics) or Religious Studies (click here [PDF] (https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9 for a list of approved courses).
- World/Comparative Religion (RELI, 3 credits): Religious Studies courses approved for this core requirement draw attention to the diversity that exists within and among traditions and encourage students to bring critical, analytical thinking to bear on the traditions and questions considered. These courses carries one of the required two global-studies designations (see below) (click here [PDF] (https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9 a list of approved courses).

Year 4 Theme and Question: Imagining the Possible: What is our role in the world?"

- Core Integration Seminar (DEPT 432, 3 credits). The Core Integration Seminar (CIS) offers students a culminating core experience in which they integrate the principles of Jesuit education, prior components of the core, and their disciplinary expertise. Some CIS courses may also count toward a student's major or minor. The CIS is offered by several departments across the University (click here [PDF] (https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9 list of CIS courses).

The Broadening Courses

- Fine Arts & Design (VART, MUSC, THEA, 3 credits): Arts courses explore multiple ways the human experience can be expressed through creativity, including across different cultures and societies. One approved course in fine arts, music, theatre, or dance will fulfill this requirement (click here [PDF] (https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9 a list of approved courses).
- History (HIST, 3 credits): History courses are intended to develop students' awareness of the historical context of both the individual and the collective human experience. One course in History (HIST 101 Foundations of the West, HIST 102 The West and the World, HIST 112 World History, HIST 103 United States History I, HIST 104 United States History II) will fulfill this requirement.
- Literature (3 credits): Literature courses foster reflection on how literature engages with a range of human experience. One approved course in Literature (offered by English, Classics, or Modern Languages) will fulfill this requirement (click here [PDF] (https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?

rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9E3A04EAD74) for a list of approved courses).

- Social & Behavioral Sciences (3 credits): Courses in the social and behavioral sciences engage students in studying human behavior, social systems, and social issues. One approved course offered by Criminal Justice, Economics, Political Science, Psychology, Sociology, or Women and Gender Studies will fulfill this requirement (click here [PDF] (https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9E3A04EAD74) for a list of approved courses).

The Designations

Designations are embedded within already existing core, major, minor, and elective courses. Students are encouraged to meet designation requirements within elective courses as their schedule allows; however, with careful planning students should be able to complete most of the designation requirements within other core, major, or minor courses.

- Writing Enriched (WE; 3 courses meeting this designation): Courses carrying the WE designation are designed to promote the humanistic and Jesuit pedagogical ideal of clear, effective communication. In addition to the required core course, Writing (ENGL 101 Writing), which carries one of the WE designations, students must take two other WE-designated courses (click here [PDF] (https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9E3A04EAD74) for a list of approved courses).
- Global-Studies (GS; 2 courses meeting this designation): Courses carrying the GS designation are designed to challenge students to perceive and understand human diversity by exploring diversity within a context of constantly changing global systems. In addition to the required core course, World/Comparative Religion (RELI 300-level), which carries one of the GS designations, students must take one other GS-designated course (click here [PDF] (https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9E3A04EAD74) for a list of approved courses).
- Social-Justice (SJ; 1 course meeting this designation): Courses carrying the SJ designation are designed to introduce students to one or more social justice concerns. Students must take one course that meets the SJ designation (click here [PDF] (https://gonzaga.azureedge.net/-/media/Website/Documents/Academics/University-Core/university-core-registration-guide.ashx?rev=42dd64be974d42c49aac56d4d16b7963&hash=7264D841F25D646771C8A9E3A04EAD74) for a list of approved courses).

Major-specific adaptations to the University Core Curriculum

All Gonzaga students, regardless of their major, will complete the University Core Curriculum requirements. However some Gonzaga students will satisfy certain core requirements through major-specific programs or courses. Any major-specific adaptations to the core are described with the requirements for the majors to which they apply.

Honors Program Requirements

Students must take the following courses to complete their Honors degree

Code	Title	Hours
HONS 100	Multi-modal Communications	3
PHIL 101	Reasoning	3
HONS 193	FYS:	3
HONS 432	CIS	3
HONS 499	Honors Senior Project	3
Select five of the following: [1]		15-16
HONS 104 & 104L	Science Inquiry and Science Inquiry Lab	
HONS 201	Honors Human Nature	
HONS 217	Honors Special Topics: Mathematics	
HONS 220	Honors Christian Catholic Traditions	
HONS 221	Honor World or Global Religion	
HONS 241	Foundations of the West	
HONS 243	Asian&PacificIslanderAmerHist	
HONS 247	Honors Special Topics in History	
HONS 267	Honors Special Topics in Art	
HONS 287	Honors Special Topics in Literature	
HONS 301	Honors Ethics	
HONS 290	Honors Colloquium [2]	3
HONS 390	Honors Colloquium [2]	3

[1] **These courses are cross-listed with regular University courses, and can fulfill core or major requirements.**

[2] **Course numbers may be repeated for credit.**

In order to remain an Honors student in good standing, a student must:

1. Complete the Honors First Year Block (HONS 193 FYS:, HONS 100 Multi-modal Communications, and PHIL 101H Reasoning: Honors) or the transfer equivalent within one academic year of joining the program.
2. Must either complete 6 credit hours of HONS courses (or courses with the Honors Designation) per academic year, or be within 12 credit hours of completing the Honors requirements. Exceptions will be made for students studying abroad during the academic year.
3. Must achieve a cumulative GPA of 3.3 at the time of graduation and good academic standing throughout their tenure at Gonzaga (as defined by the undergraduate catalogue). Students who drop below a 3.0 for two consecutive semesters will be removed from the program (subject to Director review).

Students who fail to meet these requirements will be removed from the program and no longer qualify for the Honors scholarship.