PROGRAM C, B.A./B.S.: MATHEMATICS + SPECIALIZATION

Program C allows students to earn a Mathematics degree (B.A. or B.S.) by combining courses in the Department of Mathematics with courses from one other department. In most areas of specializations, mathematical and/or quantitative courses in other departments are part of the math degree program. All Program C students take a minimum of five core math courses: Calculus I, Calculus II, Calculus III, Introduction to Linear Algebra, and a proofs course, usually either Introduction to Abstract Algebra or Fundamental Properties of Spaces and Functions I.

As of Spring 2014, the pre-approved areas of specialization are as follows: Biomathematics, Biostatistics, Chemistry, Computer Science, Economics, Engineering (each department), Finance, Optimal Business Decision-Making, Physics, Risk Management/Insurance, Statistics and Actuarial Science. All areas of specialization include electives in their plans of study. Some of the specializations have required courses in addition to the five-course mathematics core.

Every student in Program C must file a plan of study before the start of the senior year. In consultation with a mathematics advisor, a student prepares a proposed list of courses. The plan (with the advisor's endorsement) is then forwarded to the Department's Director of Undergraduate Studies for approval. If the proposal follows one of the pre-approved established templates, then approval is automatic. If a student and advisor select courses that vary from the established templates or constitute a new area of specialization, the proposed plan of study must receive the approval of the Director of the Undergraduate Program and/or the Mathematics Department Undergraduate Committee. The plans for B.A. courses usually have 11-12 courses, and the plans for B.S. courses usually have 13-14 courses (depending on the specialization).

All Program C course plans must fulfill the following four requirements.

1) **Each elective satisfying a course requirement must be at least 3 semester hours.** Combining lower semester-hour courses to satisfy one course requirement is not allowed.
2) **Every math major must take at least one upper-level math course for BA, and at least two upper-level math courses for B.S..** Upper-level Math courses are MATH:3900 or courses numbered 4000 or higher but excluding MATH:4010, 4020, and 4120 *(courses numbered 22M:096 or 22M:113 or higher excluding 22M:196-199)*.
   a) **B.A.:** All students who declared a math major in Fall 2012 and after must take at least **one upper-level math course for B.A..**
   b) **B.S.:** All students who declared a math major in Fall 2016 and after must take at least **two upper level math courses for B.S. in Program C.** The students who declared a math major in Fall 2012 and after, but before Fall 2016 must take at least **one upper-level math course for B.S..**
3) **Every subtrack has a list of approved electives.** If an area of specialization requires additional courses beyond the five core Mathematics courses, these additional courses are counted toward the electives. At least three of the approved electives that students can select must be in the mathematical sciences (Mathematics, Statistics and Actuarial Science, and Computer Science) **(MCS)** with the following restrictions.
   a) **B.A.:** At least two of these three MCS courses must have MATH (22M) prefix, and must be post-calculus.
   b) **B.S.:** All students who declared a math major in Fall 2016 and after must take at least **three post-calculus MATH courses including two upper level MATH courses for B.S..** All B.S. students who declared a math major before Fall 2016 are allowed to use the option (3a) regarding the number of the MATH electives**.**

4) **Students majoring in mathematics must satisfy the department's residency requirement.** Every math major must earn at least 15 semester hours at UI in post-calculus courses offered in Mathematical Sciences, and at least 12 s.h. of them must be offered by (or be cross-listed with) the Mathematics Department. The post-calculus courses in Mathematics **(PC)** are those with numbers higher than 2000 excluding MATH:3700, 3750, 3995-3997, 4010, and 4020 *(courses with numbers 22M:27 or higher excluding 22M:31, 32, 81, 104, 105, 109, 110 and 196-199)*. Acceptable post-calculus Computer Science and Statistics courses must have a calculus prerequisite. No transfer courses or credit by examination will be accepted for the post-calculus course residency requirement.

Core Mathematics Courses for Program C

Calculus I and Calculus II 8 s.h.

Either of the sequences MATH:1550-1560 *(22M:031-032, 8 s.h.)* or MATH:1850-1860 *(22M:025-026, 8-10 s.h.)* is acceptable. The sequences are distinct enough that the Department does not encourage students to switch from one version of Calculus I to a different version of Calculus II unless there is a strong need and good preparation. Advanced placement credit, CLEP credit, and credit obtained through the Mathematics Incentive Program is accepted for all or part of the calculus requirement.

MATH:2700 *(22M:027)* Introduction to Linear Algebra 4 s.h.

MATH:2850 *(22M:028)* Calculus III 4 s.h.

Either of MATH:3720 *(22M:050)* Introduction to Abstract Algebra I 4 s.h.
or MATH:3770 *(22M:055)* Fundamental Properties of Spaces and Functions I

Higher level courses may be substituted for core courses if approved by the Mathematics Department Director of Undergraduate Studies.

List of Mathematical Sciences Courses for Program C

1. Mathematics courses MATH: 3600 or higher, but excluding 3700, 3750, 3995-3997, 4010, 4020, and 4120 *(22M:72 or higher excluding 22M: 081, 095, 104, 105, 107, 109, 110, 196-199)*. Independent study, reading, topics, seminar, project courses are not allowed unless approved by the Math Department in advance.

2. Computer Science courses CS:1210 *(22C:016)* through CS:4740, excluding CS:2111, 3210, 3910, 3980, 3990. The independent study, reading, topics, seminar and project courses are excluded unless approved by the Mathematics Department in advance.

List: CS: 1210, 2110, 2210, 2230, 2420, 2520, 2620, 2630, 2820, 3330, 3620, 3640, 3820, 4330, 4340, 4350, 4640, and advanced electives: between 3620-4740 except 3910, 3980, and 3990.
(22C:16, 19, 21, 22, 31, 60, 80, 82, 84, 86, 111, 112, 118, 131, 135, 169, 188, and advanced electives)

3. Statistics and Actuarial Science courses that count toward an undergraduate major in Statistics or Actuarial Science, excluding independent study, reading, topics, seminar, project, exam preparation courses unless approved by the Math Department in advance.

List: Only one of STAT:2020 or 3100 or 3120 *(22S:39 or 120 or 130)* (only one of these can be counted, and only if taken before STAT:4100);

Additional accepted courses are:

STAT: 2010, 3101, 3200, 3210, 3620, 4100, 4101, 4510, 4520, 4740, 5100, 5101, 5120
ACTS: 3080, 3085, 4130, 4180, 4230, 4280, 4380
(22S:30, 131, 133, 138, 150, 152, 153, 154, 158, 169, 174, 175, 179, 180, 181, 182, 183, 190, 193, 194)

Program C Specialization: Engineering (each department) (2016)

This program requires 6 core math courses, 2-4 electives in Mathematics, plus at least 4 electives from one Engineering Department. All Program C degree requirements on upper level math courses, Mathematical Sciences courses, math residency, and 3-4 sh electives apply (see pages 1, 2). A Program C Plan of Study must be filed before the start of the senior year. Students majoring in the College of Engineering need to be aware that a mathematics degree in the College of Liberal Arts and Sciences requires different General Education courses, including the completion (or equivalent competency) of four semesters of one foreign language.

Required Core Math Courses

Option 1: Engineering sequence (16 sh)

_____ MATH:1550 *(22M:031)* Engineering Math I
_____ MATH:1560 *(22M:032)* Engineering Math II
_____ MATH:2550 *(22M:033)* Engineering Math II
_____ MATH:2560 *(22M:034)* Engineering Math IV
_____ MATH:3550 *(22M:037)* Engineering Math V

Option 2: Standard math sequence (16 sh)

_____ MATH:1850 *(22M:025)* Calculus I
_____ MATH:1860 *(22M:026)* Calculus II
_____ MATH:2700 *(22M:027)* Introduction to Linear Algebra
_____ MATH:2850 *(22M:028)* Calculus III

Option 1 and 2 courses may be combined according to the rules of Mathematics Department. Please discuss this with the Director of Undergraduate Program in Mathematics.

Required "proofs" course which must be taken in addition to Option 1 or Option 2

_____ MATH:3720 *(22M:050)* Introduction to Abstract Algebra **OR**
MATH:3770 *(22M:055)* Fundamental Properties of Spaces & Functions I

Electives

B.A. requires 6 electives. Select at least 2 electives from Group I and at least 4 electives from Group II. ***There must be at least 1 upper-level MATH course in the plan.***

B.S. requires 8 electives. Select at least 3 electives from Group I and at least 4 electives from Group II. ***There must be at least 2 upper-level MATH courses in the plan.***

Group I: Additional MATH Courses:

_____ Post-calculus MATH course beyond the core courses:
MATH:3600* or higher, but excluding 3700, 3750, 3995-3997, 4010, 4020, and 4120
(22M:72 or higher excluding 22M: 081, 095, 104, 105, 107, 109, 110, 196-199).
*Only one of MATH:2560 and 3600 *(22M:034 and 100)* counts if both are taken.

_____ (U) **Upper-level MATH course(s):**
MATH:3900 or numbered 4000 or higher but excluding MATH:4010, 4020, and 4120
(22M:096 or 22M:113 or higher excluding 22M:196-199).

Every upper level MATH course, MATH 3720, and MATH 3770 are post-calculus courses. Only one of MATH:3720 and MATH:3770 can be counted as a post-calculus elective if both are taken. Each course can satisfy only one of the course requirements, and one needs different courses to satisfy each of these requirements.

Group II: Engineering Courses: Go to the next pages.

Group II: Engineering Courses: For both B.A. and B.S., at least 4 junior- or senior-level Engineering courses are required, all from the same Engineering Department of the student's choice. The following lists contain some recommendations. These courses are chosen to have high math content. Independent study, reading, topics, seminar, lab, and project courses are not allowed unless approved by the Math Department in advance. Proposals containing Engineering courses beyond these lists must be discussed with Mathematics DUS.

Electives for ENGINEERING in PROGRAM C in MATH

Biomedical Engineering

051:182	BME:5200 Biomedical Signal Processing
051:185	BME:5210 Medical Imaging Physics
051:148	BME:5220 Digital Imaging Processing
051:186	BME:5230 Multidimensional Image Processing
051:141	BME:5251 Advanced Biosystems
051:170	BME:5401 Biomaterials & Implant Design
051:167	BME:5430 Biotransport
051:154	BME:5510 Cardiac and Vascular Mechanics
051:155	BME:5520 Cardiovascular Fluid Mechanics
051:150	BME:5610 Musculoskeletal Biomechanics

Chemical & Biochemical Engineering

The lists of electives for this department are not finalized yet. Electives are determined in consultation with the Director of the Undergraduate Program in Mathematics (DUS).

Civil & Environmental Engineering

053:136	CEE:3136 Design of Concrete Structures
053:055	CEE:3155 Principles of Environmental Engineering
053:071	CEE:3371 Principles of Hydraulics and Hydrology
053:030	CEE:3530 Soil Mechanics
053:033	CEE:3533 Principles of Structural Engineering
053:086	CEE:3586 Civil Engineering Materials
053:063	CEE:3763 Principles of Transportation
053:157	CEE:4157 Environmental Engineering Design
053:071	CEE:4370 Flow in Open Channels
053:174	CEE:4374 Water Resource Design
053:112	CEE:4512 Engineering Design Optimization
053:133	CEE:4533 Finite Element I
053:134	CEE:4535 Design of Steel Structures
053:162	CEE:4762 Design of Transportation Systems
053:163	CEE:4763 Traffic engineering
	CEE:5000 Level Courses (subject to approval by the Math Department)
	The following are already approved:
	053:169 CEE:5369 Intermediate fluid mechanics
	053:140 CEE:5540 Intermediate mechanics of deformable bodies

Electrical & Computer Engineering

055:032 ECE:3320 Intro to Digital Design
055:033 ECE:3330 Introduction to Software Design
055:035 ECE:3350 Computer Architecture and Organization
055:036 ECE:3360 Embedded Systems and Systems Software
055:043 ECE:3400 Linear Systems II
055:041 ECE:3410 Electronic Circuits
055:050 ECE:3500 Communication Systems
055:060 ECE:3600 Control Systems
055:070 ECE:3700 Electromagnetic Theory
055:072 ECE:3720 EE Materials and Devices

ECE:5000 level courses (subject to approval by the Math Department)
The following are already approved:

055:130 ECE:5300 Switching Theory
055:133 ECE:5330 Graph algorithms and combinatorial optimization
055:146 ECE:5460 Digital signal processing
055:152 ECE:5520 Intro Information & coding theory
055:150 ECE:5500 Communication theory
055:160 ECE:5600 Control theory
055:170 ECE:5700 Advanced electromagnetics

Mechanical and Industrial Engineering

058:40 ME:3040 Thermodynamics II
058:45 ME 3045 Heat Transfer
058:52 ME 3052 Mechanical Systems
058:48 ME 4048 Energy System Design
058:55 ME 4055 Mech System Design

ME 4000/5000 level courses (subject to approval by the Math Department)
The following are already approved:

058:112 ME:4112 Engineering Design Optimization
058:115 ME:4115 Finite element I
058:154 ME:5154 Intermediate kinetics & dynamics
058:160 ME:5160 Intermediate fluid mechanics

056:131 IE:3300 Manufacturing Systems
056:134 IE:3350 Process Engineering
056:144 IE:3400 Human Factors
056:147 IE:3450 Ergonomics
056:150 IE:3500 Information Systems Design
056:162 IE:3600 Quality Control
056:166 IE:3610 Stochastic Modeling
056:171 IE:3700 Operations Research
056:178 IE:3750 Digital Systems Simulation
056:176 IE:3760 Applied Linear Regression (Cross listed STAT:3200)
056:172 IE:4172 Big Data Analytics

IE: 5000 Level courses (subject to approval by the Math Department)