PROGRAM C, B.A./B.S.
MATHEMATICS + ENGINEERING
2023

Department of Mathematics encourages students of other majors to take more math courses and attempt a B.A. or B.S. secondary major, or a secondary degree if your first major is outside CLAS, in mathematics. This will benefit your future career greatly as mathematics has become more and more important in technology and society. Math Program C offers a curricular path to achieve this goal.

Students of Engineering major who declared math major for the first time in Fall 2023 or later at the UI must use this template. Students who declared math major by Summer 2023 at the UI may choose to follow this template or the previous template.

The coursework for Math Program C consists of two parts: math courses and courses from other departments. There are general course requirements as outlined on pp.1-2, while pre-approved specific course requirements for double Math + Engineering major are given on p.3.

General Requirements

1. **Standard math sequence (16 s.h.)**
   - Calculus I and Calculus II, 8 s.h.
     NOTE: Either sequence MATH:1550-1560 or MATH:1850-1860 is acceptable. The coverages of these two sequences are different so that students should not mix and match unless there is a strong need with good preparation. Advanced placement (AP), CLEP, and credits obtained through the Mathematics Incentive Program are acceptable for all or part of this calculus requirement.
   - MATH:2700 Introduction to Linear Algebra, 4 s.h.
   - MATH:2850 Calculus III, 4 s.h.
   - Higher-level math courses may be used to substitute for core math courses if approved by the Math Department Director of Undergraduate Study in advance.
2. **Or engineering math sequence (16 s.h.)**
   - MATH:1550 Engineering Math I Single Variable Calculus, 4 s.h.
   - MATH:1560 Engineering Math II Multivariable Calculus, 4 s.h.
   - MATH:2550 Engineering Math III Matrix Algebra, 2 s.h.
   - MATH:2560 Engineering Math IV Differential Equations, 3 s.h.
   - MATH:3550 Engineering Math V Vector Calculus, 3 s.h.
   - Courses in Options 1 and 2 may be mixed up to satisfy the core math course requirement if approved by Math Department Director of Undergraduate Study in advance.
3. **One required proof course**
   - MATH:3720 Introduction to Abstract Algebra I, 4 s.h., or
   - MATH:3770 Fundamental Properties of Spaces and Functions I, 4 s.h.
4. **Elective courses**

- For a B.A. degree, all students must take at least 6 electives.
- For a B.S. degree, all students must take at least 8 electives.
- Each elective here must have at least 3 s.h. Combining lower semester-hour courses to satisfy one course requirement is not allowed.

5. **Mathematics elective courses**
   - For a B.A. degree, at least 3 of the 6 electives must be math courses as define here.
   - For a B.S. degree, at least 4 of the 8 electives must be math courses as define here.
   - Mathematics (MATH) courses: MATH: 3600 or higher, but excluding 3700, 3750, 3995-3997, 4010, 4020, and 4120.
   - Independent study, reading, topics, seminar, and project courses are not allowed unless approved by the Math Department Director of Undergraduate Study in advance.
6. **Upper-level math courses**
   - For a B.A. degree, at least 1 of the 3 math courses must be an upper-level math course.
   - For a B.S. degree, at least 2 of the 4 math courses must be upper-level math courses.
   - Upper-level math courses are MATH:3900 and MATH courses numbered 4000 or higher except MATH:4010, 4020, and 4120.
   - MATH courses numbered 6000 or above are not allowed unless approved by the Math Department Director of Undergraduate Study in advance.
7. **Other electives**
   - Pre-approved electives for Mathematics + Engineering are listed on p.3.
   - If a student and their advisor select courses which are not listed on p.3 of this template, approval is required from Math Department Director of Undergraduate Study in advance.
8. **Residency requirement of the Math Department**
   - Every math major must earn at least 15 s.h. at the UI in courses offered by the Department of Mathematics or cross-listed with a MATH-prefixed course.
9. **Plan of study**
   - Every Program C student must file a Plan of Study before the start of their senior year. With the help of their advisor, a student prepares a list of courses as their Plan of Study according to Requirements 1-8 above. With advisor's approval, this Plan of Study is then submitted to the Math Department Director of Undergraduate Study for approval. Approved Plan of Study will be uploaded and appear in MyUI.
   - If a student needs to change courses, a new Plan of Study must be submitted.
   - Please use this Fillable PDF Form for Plan of Study for Program C.
10. **Math Department and college's requirements**
    - Students earning a major or degree in mathematics must also satisfy the Math Department's rules and the requirements of the College of Liberal Arts and Sciences.
    - More information about CLAS regulations can be found in the University of Iowa General Catalog.

Pre-approved Template for Mathematics + Engineering 2023

1. **Required core math courses**
   - 5 core math courses for standard math track (General Requirements #1 and #3, p.1), or
   - 6 core math courses for engineering track (General Requirements #2 and #3, p.1).
2. **Elective courses for B.A.**
   - 6 electives beyond the core math courses above are required.
   - At least 3 electives must be from Group I below.
   - At least 3 electives must be from Group II. They must be from the same engineering department of student's choice.
   - Of the 3 electives from Group I, at least one must be an upper-level math course.
3. **Elective courses for B.S.**
   - 8 electives beyond the core math courses above are required.
   - At least 4 electives must be from Group I.
   - At least 4 electives must be from Group II. They must be from the same engineering department of student's choice.
   - Of the 4 electives from Group I, at least 2 must be upper-level math courses.
4. **Group I: math courses**
   - MATH:3600 or higher excluding MATH:3700, 3750, 3995-3996, 4010, 4020, and 4120.
   - Only one of MATH:2560 and MATH:3600 can be counted if both are taken.
   - If both MATH:3720 and MATH:3770 are taken, one will be counted as a Core Math Course and the other will be counted as an elective.
   - Each course can fulfill only one course requirement.
   - Upper-level math courses as defined in #6 on p.2.
5. **Group II: Engineering courses**

   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 Director of Undergraduate Study in advance. Proposals for taking Engineering courses beyond these lists must be approved by the Math Department Director of Undergraduate Study in advance.

   - **Biomedical Engineering**
     - BME:5200 Biomedical Signal Processing
     - BME:5210 Medical Imaging Physics
     - BME:5220 Digital Imaging Processing
     - BME:5230 Multidimensional Image Processing
     - BME:5251 Advanced Biosystems
     - BME:5401 Biomaterials & Implant Design
     - BME:5430 Biotransport
     - BME:5510 Cardiac and Vascular Mechanics
     - BME:5520 Cardiovascular Fluid Mechanics

  - BME:5610 Musculoskeletal Biomechanics
- **Chemical & Biochemical Engineering**
  - A list of electives for this department has not been finalized yet. Electives may be determined by consultation with the Math Department Director of Undergraduate Study in advance.
- **Civil & Environmental Engineering**
  - CEE:3136 Design of Concrete Structures
  - CEE:3155 Principles of Environmental Engineering
  - CEE:3371 Principles of Hydraulics and Hydrology
  - CEE:3530 Soil Mechanics
  - CEE:3533 Principles of Structural Engineering
  - CEE:3586 Civil Engineering Materials
  - CEE:3763 Principles of Transportation
  - CEE:4157 Environmental Engineering Design
  - CEE:4370 Flow in Open Channels
  - CEE:4374 Water Resource Design
  - CEE:4512 Engineering Design Optimization
  - CEE:4533 Finite Element I
  - CEE:4535 Design of Steel Structures
  - CEE:4762 Design of Transportation Systems
  - CEE:4763 Traffic engineering
  - CEE:5369 Intermediate fluid mechanics
  - CEE:5540 Intermediate mechanics of deformable bodies
  - Other 5000-level courses to be approved by Math Department Director of Undergraduate Study in advance.
- **Electrical & Computer Engineering**
  - ECE:3320 Intro to Digital Design
  - ECE:3330 Introduction to Software Design
  - ECE:3350 Computer Architecture and Organization
  - ECE:3360 Embedded Systems and Systems Software
  - ECE:3400 Linear Systems II
  - ECE:3410 Electronic Circuits
  - ECE:3500 Communication Systems
  - ECE:3600 Control Systems
  - ECE:3700 Electromagnetic Theory
  - ECE:3720 EE Materials and Devices
  - ECE:5300 Switching Theory
  - ECE:5330 Graph algorithms and combinatorial optimization
  - ECE:5460 Digital signal processing
  - ECE:5520 Intro Information & coding theory
  - ECE:5500 Communication theory
  - ECE:5600 Control theory

  - ECE:5700 Advanced electromagnetics
  - Other 5000-level courses to be approved by Math Department Director of Undergraduate Study in advance.
- **Industrial Engineering**
  - IE:3300 Manufacturing Systems
  - IE:3350 Process Engineering
  - IE:3400 Human Factors
  - IE:3450 Ergonomics
  - IE:3500 Information Systems Design
  - IE:3600 Quality Control
  - IE:3610 Stochastic Modeling
  - IE:3700 Operations Research
  - IE:3750 Digital Systems Simulation
  - IE:3760 Applied Linear Regression (Cross listed STAT:3200)
  - IE:4172 Big Data Analytics
  - 5000-level courses to be approved by Math Department Director of Undergraduate Study in advance.
- **Mechanical Engineering**
  - ME:3040 Thermodynamics II
  - ME 3045 Heat Transfer
  - ME 3052 Mechanical Systems
  - ME 4048 Energy System Design
  - ME 4055 Mech System Design
  - ME:4112 Engineering Design Optimization
  - ME:4115 Finite element I
  - ME:5154 Intermediate kinetics & dynamics
  - ME:5160 Intermediate fluid mechanics
  - Other 4000- and 5000-level courses to be approved by Math Department Director of Undergraduate Study in advance.