Major Course Requirements for
Dept. of Mathematical Sciences
(For undergraduate students admitted in 2015 or before)

Please check the common graduation requirements.

▣ **Credit Requirement for Graduation:** Required to complete a total of more than 130 credits

▣ **Elective Basic and Prerequisite Course Requirements:**
※ Elective Basic Courses: at least 9 credits (including at least two courses among MAS109, MAS201 and MAS202)
  - Students who entered in 2011 or before, only need at least 6 credits
  - Students with a double major only need at least 3 credits which must include either MAS201 or MAS202

▣ **Major**: at least 42 credits
  ○ **Mandatory Major Courses:** None
  ○ **Elective Major Courses:** 42 credits
   * Must include 4 courses selected from the following courses:
      MAS212 Linear Algebra, MAS241 Analysis I, MAS311 Modern Algebra I,
      MAS321 Introduction to Differential Geometry, MAS331 Topology,
      MAS341 Complex Variables, MAS250 Probability and Statistics
   * The courses of other departments listed below can be regarded as major courses up to 9 credits.
     - PH212 Mathematical Methods in Physics II, PH221 Classical Mechanics I,
       PH301 Quantum Mechanics I
     - MAE200 Fluid Mechanics or MAE221 Fluid Mechanics, MAE230 Solid Mechanics or
       MAE231 Solid Mechanics
     - IE331 Operations Research I, IE341 Engineering Statistics II,
       IE342 Regression Analysis and Experimental Designs
     - EE202 Signals and Systems, EE204 Electromagnetics or PH231 Electromagnetism I,
       EE321 Communication Engineering
     - CS206 Data Structure, CS300 Introduction to Algorithms
   * MAS250 can be regarded as the elective major course for students in
      Department of Mathematical Sciences (including double major students)
   * Certificates (Optional)
     - If at least four courses on the list below are completed, `Certificate in Financial
       Mathematics' is written in the transcript :
       Mathematical Statistics, Introduction to Numerical Analysis, Introduction to Financial

Mathematics, Lebesgue Integral Theory, Financial Mathematics and Stochastic Models, Computer Simulations in Financial Mathematics

- If at least four courses on the list below are completed, `Certificate in Applied Mathematics' is written in the transcript :
  Applied Mathematics and Modeling, Elementary Probability Theory, Mathematical Statistics, Introduction to Numerical Analysis, Optimization Theory, Introduction to Partial Differential Equations
- If at least four courses on the list below are completed, `Certificate in Information Mathematics' is written in the transcript :
  Discrete Mathematics, Modern Algebra II, Mathematical Statistics, Information Mathematics, Introduction to Cryptography
- If Certificate requirements are met for more than one, then only one Certificate of the student's choice is written in the transcript.

◼ **Minor** : at least 18 credits
  - Must take 18 credits from the major courses of the Department of Mathematical Sciences (No mandatory major courses).

◼ **Double Major** : at least 40 credits
  - Must include 4 courses selected from the following courses:
    MAS212 Linear Algebra, MAS241 Analysis I, MAS311 Modern Algebra I, MAS321 Introduction to Differential Geometry, MAS331 Topology, MAS341 Complex Variables, MAS250 Probability and Statistics
    ※A maximum of overlapping 9 credits earned in major courses offered by other academic organizations can be recognized.

◼ **Research Courses:** at least 3 credits
  - MAS490 Research in Mathematics (3 credits)
  - MAS491 Introduction to Contemporary Mathematics (2 credits)
  - MAS495 Individual Study (1 credits)
  - INT485 National Internship Program III (Graduation Research) (3 credits)
  - INT484 National Internship Program II (Graduation Research) (2 credits)
  - INT483 National Internship Program I (Graduation Research) (1 credits)
  * Note that if one take MAS495 more than one times, department acknowledges only 1 credit toward research credits, and the rest are considered as elective courses.
  * For students with a minor in other departments, Individual Study in their minor department counts for up to 1 credit (applies for all students).

☐ **Transitional measures**
Students admitted in 2015 or before may choose to be governed by the completion requirements applicable to students admitted in 2016 and after if desired.

Major Course Requirements for
Dept. of Mathematical Sciences
(For undergraduate students admitted in 2016 and after)

Please check the common graduation requirements.

◼ **Credit Requirement for Graduation:** Required to complete a total of more than 136 credits

※ Required to choose and complete one among Advanced Major, Double Major, Minor, and Individually Designed Major.

◼ **Elective Basic and Prerequisite Course Requirements:**

※ Elective Basic Courses: at least 9 credits (including at least two courses among MAS109, MAS201, MAS202 and MAS250)

  - Students with a double major must take at least 3 credits including at least one course among MAS201, MAS202 and MAS250

◼ **Major**: at least 42 credits

  ○ **Mandatory Major Courses:** None

  ○ **Elective Major Courses:** 42 credits

  * Must include 4 courses selected from the following course:

    MAS212 Linear Algebra, MAS241 Analysis I, MAS311 Modern Algebra I,

    MAS321 Introduction to Differential Geometry, MAS331 Topology,

    MAS341 Complex Variables, MAS355 Mathematical Statistics

  * The courses of other departments listed below can be regarded as major courses up to 9 credits.

    - PH212 Mathematical Methods in Physics II, PH221 Classical Mechanics I,
       PH301 Quantum Mechanics I

    - MAE200 Fluid Mechanics or MAE221 Fluid Mechanics, MAE230 Solid Mechanics or
       MAE231 Solid Mechanics

    - IE331 Operations Research I, IE341 Engineering Statistics II,
       IE342 Regression Analysis and Experimental Designs

    - EE202 Signals and Systems, EE204 Electromagnetics or PH231 Electromagnetism I,
       EE321 Communication Engineering

    - CS206 Data Structure, CS300 Introduction to Algorithms

  * Certificate in Financial (Optional)

    - If at least four courses on the list below are completed, `Certificate in Financial
       Mathematics' is written in the transcript :

Mathematical Statistics, Introduction to Numerical Analysis, Introduction to Financial Mathematics, Lebesgue Integral Theory, Financial Mathematics and Stochastic Models, Computer Simulations in Financial Mathematics

▣ **Advanced Major :** at least 13 credits
  - The following 4 courses (13 credits) are required:
  MAS242 Analysis II, MAS312 Modern Algebra II, MAS430 Combinatorial Topology, MAS440 Introduction to Partial Differential Equations

▣ **Individually Designed Major :** at least 12 credits
  - Must take a total of 12 credits selected from among the major courses of at least two other departments.

▣ **Minor:** at least 18 credits
  - Must take at least 18 credits selected from the major courses of the Department of Mathematical Sciences (No mandatory major courses).
  ※ Major courses of other departments are not duplicately accepted.

▣ **Double Major :** at least 40 credits
  - Must include 4 courses selected from the following courses:
  MAS212 Linear Algebra, MAS241 Analysis I, MAS311 Modern Algebra I, MAS321 Introduction to Differential Geometry, MAS331 Topology, MAS341 Complex Variables, MAS250 Probability and Statistics
  ※ Major courses of other departments are duplicately accepted, up to 6 credits.

▣ **Research Courses:** at least 3 credits
 - MAS490 Research in Mathematics (3 credits)
 - MAS491 Introduction to Contemporary Mathematics (2 credits)
 - MAS495 Individual Study (1 credit)
 - INT485 National Internship Program III (Graduation Research) (3 credits)
 - INT484 National Internship Program II (Graduation Research) (2 credits)
 - INT483 National Internship Program I (Graduation Research) (1 credit)
  * Note that if one take MAS495 more than one time, the department acknowledges only 1 credit toward research credits, and the rest are considered as elective courses.
  * For students with a minor in another department, Individual Study in their minor department counts for up to 1 credit (applies for all students).

□ **Transitional measures**
Students admitted in 2015 or before may choose to be governed by the completion requirements listed above if desired.

Major Course Requirements for Dept. of Mathematical Sciences (For Master's Program)

Thesis Master's Degree Program

Please check the common graduation requirements.

▣ **Credit Requirement for Graduation:** Required to complete a total of more than 36 credits

▣ **Mandatory General Courses:** 3 credits and 1AU
  ○ One course (3 credits) from CC500, CC510, CC513, CC530, CC532

▣ **Mandatory Major Courses**: None

▣ **Elective Courses:** at least 21 credits
  ○ Must include 4 courses selected from the following 8 courses :
    Algebra I, Differential Geometry I, Algebraic Topology I, Real Analysis, Complex Function Theory, Probability Theory, Advanced Statistics, Numerical Analysis

▣ **Research Courses:** at most 12 credits
  ○ Research Course Requirements: at most 12 credits, including 1 credit for Seminar(M.S.) and 1 credit for MAS967 `How to Teach Mathematics I. (M.S.)'. Foreign students are exempt from MAS967 requirement.

Coursework Master's Degree Program

Please check the common graduation requirements.

▣ **Credit Requirement for Graduation:** Required to complete a total of more than 36 credits

▣ **Mandatory General Courses:** 3 credits and 1AU
  ○ One course (3 credits) from CC500, CC510, CC513, CC530, CC532

▣ **Mandatory Major Courses:** None

◉ **Elective Courses:** at least 30 credits
- ○ Must include 4 courses selected from the following 8 courses :
  Algebra I, Differential Geometry I, Algebraic Topology I, Real Analysis,
  Complex Function Theory, Probability Theory, Advanced Statistics, Numerical
  Analysis

◉ **Research Courses:** at most 3 credits, including 1 credit for Seminar(M.S.)
and 1 credit for MAS967 `How to Teach Mathematics I. (M.S.)'.
Foreign students are exempt from MAS967 requirement.

☐ **Transitional Measures**
- ○ Seminar(M.S.) and Seminar(Ph.D.) are accepted as Research Course credits for all students in the respective M.S. and Ph.D. programs, regardless of the year they entered the program.
- ○ These graduation requirements are applicable for students who entered in 2015 or after. Students who entered in 2014 or before should complete either these requirements or alternatively, the previous requirements.
- ○ Graduation credit requirements (66 credits in total, Elective Courses 33 credits) are applicable for students who entered in 2009 or after.
- ○ These graduation requirements are applicable for students who entered in 2007 or after. Students who entered in 2006 or before can follow either these requirements or alternatively, the version in 2006.
- ○ Ph.D. students who selected the mathematics major in 2006 or before and have taken MAS966 Seminar(M.S.) for at least 2 credits in their M.S. program may omit MAS986 Seminar(Ph.D.).
- ※ Other unaddressed regulations or unforeseen situations are subject to department decisions

Major Course Requirements for
Dept. of Mathematical Sciences
(For Doctoral Program)

Please check the common graduation requirements.

▣ **Credit Requirement for Graduation:** Required to complete a total of more than 66 credits

▣ **Mandatory General Courses:** 3 credits and 1AU
  ○ Those students who completed the required common courses in the master's program do not need to repeat them
  ○ One course (3 credits) from CC500, CC510, CC513, CC530, CC532

▣ **Mandatory Major Courses:** None

▣ **Elective Courses:** at least 33 credits
  ○ Must include 4 courses selected from the following 8 courses :
  Algebra I, Differential Geometry I, Algebraic Topology I, Real Analysis, Complex Function Theory, Probability Theory, Advanced Statistics, Numerical Analysis

▣ **Research Courses:** at most 30 credits, including 2 credits for Seminar(Ph.D.) and 1 credit for MAS987 `How to Teach Mathematics I.(Ph.D.)'.
  Foreign students are exempt from MAS987 requirement.
  Students who have taken MAS967 in the master's program may omit it in the Ph.D. program.

☐ **Transitional Measures**
  ○ Seminar(M.S.) and Seminar(Ph.D.) are accepted as Research Course credits for all students in the respective M.S. and Ph.D. programs, regardless of the year they entered the program.
  ○ These graduation requirements are applicable for students who entered in 2015 or after. Students who entered in 2014 or before should complete either these requirements or alternatively, the previous requirements.
  ○ Graduation credit requirements (66 credits in total, Elective Courses 33 credits) are applicable for students who entered in 2009 or after.
  ○ These graduation requirements are applicable for students who entered in 2007 or after. Students who entered in 2006 or before can follow either

these requirements or alternatively, the version in 2006.

○ Ph.D. students who selected the mathematics major in 2006 or before and have taken MAS966 Seminar(M.S.) for at least 2 credits in their M.S. program may omit MAS986 Seminar(Ph.D.).

※ Other unaddressed regulations or unforeseen situations are subject to department decisions

Major Course Requirements for
Dept. of Mathematical Sciences
(For MS-PhD Integrated Program)

Please check the common graduation requirements.

▣ **Credit Requirement for Graduation:** Required to complete a total of more than 66 credits

▣ **Mandatory general Courses**: 3 credits and 1AU (those students who completed the required common courses in the master's program do not need to repeat them)
  ○ One course (3 credits) from CC500, CC510, CC513, CC530, CC532

▣ **Mandatory Major Courses:** None

▣ **Elective Courses:** at least 33 credits
  ○ Must include 4 courses selected from the following 8 courses :
     Algebra I, Differential Geometry I, Algebraic Topology I, Real Analysis, Complex Function Theory, Probability Theory, Advanced Statistics, Numerical Analysis

▣ **Research Courses**: at least 30 credits, including 2 credits for Seminar(M.S.) or Seminar(Ph.D.) and 1 credit for MAS967 'How to Teach Mathematics I. (M.S.)' or MAS987 `How to Teach Mathematics I.(Ph.D.)'. Foreign students are exempt from MAS967 or MAS987 requirement.

☐ **Transitional Measures**
  ○ Seminar(M.S.) and Seminar(Ph.D.) are accepted as Research Course credits for all students in the respective M.S. and Ph.D. programs, regardless of the year they entered the program.
  ○ These graduation requirements are applicable for students who entered in 2015 or after. Students who entered in 2014 or before should complete either these requirements or alternatively, the previous requirements.
  ○ Graduation credit requirements (66 credits in total, Elective Courses 33 credits) are applicable for students who entered in 2009 or after.
  ○ These graduation requirements are applicable for students who entered in 2007 or after. Students who entered in 2006 or before can follow either these requirements or alternatively, the version in 2006.
  ○ Ph.D. students who selected the mathematics major in 2006 or before and have taken MAS966 Seminar(M.S.) for at least 2 credits in their M.S.

program may omit MAS986 Seminar(Ph.D.).

※ Other unaddressed regulations or unforeseen situations are subject to department decisions