

2011-2012 PRE-COMBINED PLAN CURRICULUM GUIDE

In order to be considered for guaranteed admission, students must successfully complete the equivalents of the following Columbia courses at their home institution. Please see the [Course Descriptions](#) document for course descriptions. **You should touch base with the liaison at your school in order to determine which classes fulfill these Columbia prerequisite courses.** You should also speak with your liaison about other ways to fulfill prerequisites if your institution does not offer a required course listed in this guide.

Please note that all courses in this guide (except for the 27 non-technical credit hours) count towards the calculated pre-engineering GPA.

For more information, please visit our website at <http://www.studentaffairs.columbia.edu/admissions/engineering/combined> or e-mail us at combinedplan@columbia.edu.

FOUNDATION COURSES REQUIRED OF ALL MAJORS:

- i. MATHEMATICS
 - The full sequence of Calculus I, II, III, IV (Math10a, Math10b, Math20a, Math35a)
- ii. PHYSICS
 - Mechanics and Thermodynamics (Phys11a or Phys15a)
 - Electricity, Magnetism, and Optics (Phys11b or Phys15b)
- iii. CHEMISTRY
 - General Chemistry I (Chem11a or Chem15a)
 - Please see individual programs below for details. Some programs require an additional second semester of General Chemistry (C1404) or have possible substitutions.*
- iv. LAB REQUIREMENT
 - Either one-semester physics lab or one-semester chemistry lab is generally required. Please see individual programs below for more details.*
- v. COMPUTER SCIENCE
 - Introduction to computer science and programming in C++, JAVA, or MATLAB (Cosi11a or Cosi177a)
 - Some majors require a specific programming language (see requirements for majors below).*
- vi. HUMANITIES AND SOCIAL SCIENCES
 - Twenty-seven-(27) non-technical credit hours. **Please speak with your liaison in regards to which courses fulfill this requirement, as coursework taken for the bachelor's degree awarded by the home institution often fulfills this requirement.** Among these courses the students must include:
 - Principles of Economics (Econ2a)
 - English Composition (UWS).

REQUIRED MAJOR SPECIFIC COURSES

(Notes in *italics* clarify requirements.)

APPLIED MATHEMATICS or APPLIED PHYSICS

MATHEMATICS

- ❑ Ordinary Differential Equations (Math37a)

PHYSICS

- ❑ Classical and Quantum Waves (Phys20a)
- ❑ Physics Lab (Phys19a and Phys19b)

CHEMISTRY / BIOLOGY (choose one course listed below. Chemistry/Biology labs not required.)

- ❑ General Chemistry I (Chem11a or Chem15a)
- ❑ Environmental Biology: Molecules to Cells (no equivalent)
- ❑ Introduction to Molecular and Cellular Biology (Bio122b)

BIOMEDICAL ENGINEERING (ALL TRACKS)

MATHEMATICS

- ❑ Introduction to applied mathematics – Ordinary Differential Equations & Linear Algebra (Math15a and Math37a).

Students who take an ODE course must also take a Linear Algebra course.

PHYSICS

- ❑ Classical and Quantum Waves (Phys20a)

CHEMISTRY

- ❑ General Chemistry II (Chem11b or Chem15b)
- ❑ General Chemistry Lab (Chem19a and Chem19b)
- ❑ Organic Chemistry I (Chem25a)

ELECTRICAL ENGINEERING

- ❑ Introduction to Electrical Engineering (no equivalent) [*may be taken the summer before entering or while at Columbia*]

ENGINEERING MECHANICS

- ❑ Mechanics (no equivalent) [*may be taken the summer before entering or while at Columbia*]

COMPUTER SCIENCE

Introduction to Computer Science and Programming in MATLAB (Cosi177a) preferred

CHEMICAL ENGINEERING

MATHEMATICS (*choose one course listed below*)

- ❑ Ordinary Differential Equations (Math37a)
- ❑ Introduction to applied mathematics – Ordinary Differential Equations & Linear Algebra (no equivalent)

PHYSICS

- ❑ Physics Lab (Phys19a and Phys19b)

CHEMISTRY

- ❑ General Chemistry II (Chem11b or Chem15b)
 - ❑ General Chemistry Lab (Chem19a and Chem19b)
 - ❑ Organic Chemistry I (Chem25a)
 - ❑ Organic Chemistry Lab (Chem29a)
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CIVIL ENGINEERING

MATHEMATICS

- ❑ Introduction to applied mathematics – Ordinary Differential Equations & Linear Algebra (APMA E2101).
Students who take an ODE course must also take a Linear Algebra course.

PHYSICS/CHEMISTRY LAB (*choose one course listed below*)

- ❑ Physics Lab (Phys19a and Phys19b)
- ❑ General Chemistry Lab (Chem19a and Chem19b)

ENGINEERING MECHANICS

- ❑ Mechanics (no equivalent) [*may be taken the summer before entering or while at Columbia*]

COMPUTER SCIENCE

Introduction to Computer Science and Programming in MATLAB (Cosi177a) preferred

COMPUTER ENGINEERING

MATHEMATICS

- ❑ Introduction to applied mathematics – Ordinary Differential Equations & Linear Algebra .
(Math15a and Math37a)

PHYSICS/CHEMISTRY LAB (*choose one course listed below*)

- ❑ Physics Lab (Phys19a and Phys19b)
- ❑ General Chemistry Lab (Chem19a and Chem19b)

COMPUTER SCIENCE (*Computer Programming in JAVA is required.*)

- ❑ Discrete Mathematics (Cosi29a)

ELECTRICAL ENGINEERING

- ❑ Introduction to Electrical Engineering (no equivalent) [*may be taken the summer before entering or while at Columbia*]
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COMPUTER SCIENCE

PHYSICS/CHEMISTRY LAB (*choose one course listed below*)

- ❑ Physics Lab (Phys19a and Phys19b)
- ❑ General Chemistry Lab (Chem19 and Chem19b)

COMPUTER SCIENCE (*Computer Programming in JAVA is required.*)

- ❑ Data Structures and Algorithms (Cosi21a)
 - ❑ Discrete Mathematics (Cosi29a)
 - ❑ Scientific Computation (Cosi177a)
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EARTH AND ENVIRONMENTAL ENGINEERING

MATHEMATICS

- ❑ Introduction to applied mathematics – Ordinary Differential Equations & Linear Algebra.
Students who take an ODE course must also take a Linear Algebra course. (Math15a and Math37a)

CHEMISTRY

- ❑ General Chemistry II (Chem11b or Chem15b)
- ❑ General Chemistry Lab (Chem19a and Chem19b)

OTHER SCIENCE ELECTIVE (*choose one course listed below*)

- ❑ Organic Chemistry (Chem25a)
- ❑ Classical & quantum waves (Phys20a)
- ❑ Introduction to Molecular and Cellular Biology (Bio122b)

EARTH AND ENVIRONMENTAL SCIENCES (*choose one course listed below*)

- ❑ Advanced General Geology (no equivalent) [*maybe taken while at Columbia.*]
- ❑ The Climate System (no equivalent) [*maybe taken while at Columbia.*]
- ❑ The Solid Earth System (no equivalent) [*maybe taken while at Columbia.*]

EARTH AND ENVIRONMENTAL ENGINEERING

- ❑ Alternative Energy Resources (no equivalent) [*maybe taken at Columbia*]
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ELECTRICAL ENGINEERING

MATHEMATICS

- ❑ Introduction to applied mathematics – Ordinary Differential Equations & Linear Algebra.
Students who take an ODE course must also take a Linear Algebra course (Math15a and Math37a).

PHYSICS

- ❑ Classical and Quantum Waves (Phys20a)
- ❑ Physics Lab (Phys19a and Phys19b)

COMPUTER SCIENCE

Computer Programming in JAVA is recommended.

ELECTRICAL ENGINEERING

- ❑ Introduction to Electrical Engineering [*maybe taken the summer before entering or while at Columbia*]

IEOR: ENGINEERING MANAGEMENT SYSTEMS

MATHEMATICS (*choose one course listed below*)

- ❑ Linear Algebra (Math15a)

PHYSICS/CHEMISTRY LAB (*choose one course listed below*)

- ❑ Physics Lab (Phys19a and Phys19b)
- ❑ General Chemistry Lab (Chem19a and Chem19b)

COMPUTER SCIENCE (*choose one set of courses below*)

- ❑ Computer Programming in C
 - ❑ Data Structures in C
- or-
- ❑ Computer Programming in JAVA (Cosi11a)
 - ❑ Data Structures in JAVA (Cosi21a)

*The Department **strongly** recommends JAVA over C.*

ECONOMICS

- ❑ Introduction to Accounting and Finance (Bus6a)

PROBABILITY AND STATISTICS

- ❑ Introduction to Probability and Statistics (Econ83a or Math36a and Math36b)
*Please note that the course must have calculus as a pre-requisite. The Department **strongly** suggests taking two separate courses: one in Probability and one in Statistics.*

IEOR: FINANCIAL ENGINEERING

Students cannot apply directly to IEOR: Financial Engineering because this concentration in Operations Research requires an application after one semester of study at Columbia. Entrance into this program is very competitive. Students interested in this concentration must adhere to the following pre-requisite requirements:

MATHEMATICS

- ❑ Linear Algebra (Math15a)
- ❑ Ordinary Differential Equations (Math37a)

PHYSICS/CHEMISTRY LAB (*choose one course listed below*)

- ❑ Physics Lab (Phys19a and Phys19b)
- ❑ General Chemistry Lab (Chem19 and Chem19b)

COMPUTER SCIENCE (*choose one set of courses below*)

- ❑ Computer Programming in C
 - ❑ Data Structures in C
- or-
- ❑ Computer Programming in JAVA (Cosi11a)
 - ❑ Data Structures in JAVA (Cosi21a)

*The Department **strongly** recommends JAVA over C.*

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ECONOMICS

- ❑ Introduction to Accounting and Finance (Bus6a)

PROBABILITY AND STATISTICS

- ❑ Probability (Math36a)
- ❑ Statistical Inference (Math36b)

Please note that the course must have calculus as a pre-requisite.

IEOR: INDUSTRIAL ENGINEERING

MATHEMATICS (*choose one course listed below*)

- ❑ Linear Algebra (MATH V2010 or APAM E3101)

PHYSICS/CHEMISTRY LAB (*choose one course listed below*)

- ❑ Physics Lab (Phys19a and Phys19b)
- ❑ General Chemistry Lab (Chem19a and Chem19b)

COMPUTER SCIENCE (*choose one set of courses below*)

- ❑ Computer Programming in C
- ❑ Data Structures in C
- or-
- ❑ Computer Programming in JAVA (Cosi11a)
- ❑ Data Structures in JAVA (Cosi21a)

*The Department **strongly** recommends JAVA over C.*

ECONOMICS

- ❑ Introduction to Accounting and Finance (Bus6a)

PROBABILITY AND STATISTICS

- ❑ Introduction to Probability and Statistics (Econ83a or Math36a and Math36b)
*Please note that the course must have calculus as a pre-requisite. The Department **strongly** suggests taking two separate courses: one in Probability and one in Statistics.*
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IEOR: OPERATIONS RESEARCH

MATHEMATICS

- ❑ Linear Algebra (Math15a)

PHYSICS/CHEMISTRY LAB *(choose one course listed below)*

- ❑ Physics Lab (Phys19a and Phys19b)
- ❑ General Chemistry Lab (Chem19a and Chem19b)

COMPUTER SCIENCE *(choose one set of courses below)*

- ❑ Computer Programming in C
- ❑ Data Structures in C
- or-
- ❑ Computer Programming in JAVA (Cosi11a)
- ❑ Data Structures in JAVA (Cosi21a)

*The Department **strongly** recommends JAVA over C.*

ECONOMICS

- ❑ Introduction to Accounting and Finance (Bus6a)

PROBABILITY AND STATISTICS

- ❑ Introduction to Probability and Statistics (Econ83a or Math36a and Math36b)
*Please note that the course must have calculus as a pre-requisite. The Department **strongly** suggests taking two separate courses: one in Probability and one in Statistics.*

ENGINEERING MECHANICS

MATHEMATICS

- ❑ Ordinary Differential Equations (Math37a)

PHYSICS/CHEMISTRY LAB *(choose one course listed below)*

- ❑ Physics Lab (Phys19a and Phys19b)
- ❑ General Chemistry Lab (Chem19a and Chem19b)

ENGINEERING MECHANICS

- ❑ Mechanics (no equivalent) *[may be taken the summer before entering or while at Columbia]*

MATERIALS SCIENCE AND ENGINEERING

MATHEMATICS

- ❑ Ordinary Differential Equations (Math37a)

PHYSICS

- ❑ Classical and Quantum Waves (Phys20a)
- ❑ Physics Lab (Phys19a and Phys19b)

CHEMISTRY

- ❑ General Chemistry II (Chem11b or Chem15b)
- ❑ General Chemistry Lab (Chem19a and Chem19b)

MECHANICAL ENGINEERING

MATHEMATICS

- ❑ Introduction to applied mathematics – Ordinary Differential Equations & Linear Algebra.
Students who take an ODE course must also take a Linear Algebra course (Math15a and Math37a).

PHYSICS/ BIOLOGY (*choose one course listed below*)

- ❑ Classical and Quantum Waves (Phys20a)
- ❑ Environmental Biology: Molecules to Cells (no equivalent)
- ❑ Introduction to Molecular and Cellular Biology (Bio122b)

PHYSICS/CHEMISTRY LAB (*choose one course listed below*)

- ❑ Physics Lab (Phys19a and Phys19b)
- ❑ General Chemistry Lab (Chem19a and Chem19b)

ENGINEERING MECHANICS

- ❑ Mechanics (no equivalent) [*may be taken while at Columbia*]

ELECTRICAL ENGINEERING

- ❑ Intro. to Electrical Engineering (no equivalent) or equivalent [*may be taken while at Columbia*]
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Additional comments for establishing the equivalence between Brandeis and Columbia courses:

1. It is highly encouraged that students take Phys15a,b or Phys11a,b instead of Phys10a,b. However, if students have already taken Phys10a,b it will be counted toward their Columbia engineering requirements.
2. It is highly encouraged that students take Phys19a,b instead of Phys18a,b. However, if students have already taken Phys 18a,b it will be counted toward their Columbia engineering requirements.
3. It is highly encouraged that students take Chem19a,b instead of Chem18a,b. However, if students have already taken Chem18a,b it will be counted toward their Columbia engineering requirements.
4. Math22a can be taken instead of Math15a and Math22b can be taken instead of Math20a.