

2013-14 COMBINED PLAN CURRICULUM GUIDE

The Combined Plan Program is founded on an articulation arrangement between The Fu Foundation School of Engineering and Applied Science at Columbia University and over 100 affiliate institutions nationwide.

Admission to the program is **guaranteed** if a student successfully completes **all of** the following requirements:

The candidate must be enrolled full-time at an affiliate institution for at least the past two years.

The candidate must achieve the minimum overall **and** pre-engineering GPA at the affiliate:
Entry at affiliate prior to fall 2011: 3.0.
Entry at affiliate in/after fall 2011: 3.30.

A candidate who entered affiliate in fall 2011 must obtain a minimum grade of B (3.0) on the first attempt in each prerequisite course (both foundational and major-specific).

The candidate completes **both** the **foundational** coursework and the **major-specific** coursework at the affiliate institution by the end of the spring semester of application.

All courses and course credit must be noted on the transcript from the affiliate institution. For students entering the affiliate in/after fall 2011, all prerequisite courses must be taken at the affiliate.

The candidate must complete the **degree** and **major** requirements of the affiliate institution by the end of the spring semester of application.

The candidate must submit three favorable recommendation letters: one each from the Combined Plan liaison, a science instructor and a math instructor.

For students entering the affiliate in/after fall 2011: A candidate whose native language is not English must demonstrate English language proficiency as directed by Columbia.

Applicants who do not meet the above criteria may apply, but admission is not guaranteed and students will be considered in our competitive review process. The requirements of guaranteed admission are used as guidelines for this review process.

DEFINITIONS AND POLICIES

Overall GPA: The overall GPA will be calculated by Columbia using *all postsecondary courses that a student has received credit for on their home institution's transcript*. A student must submit all official transcripts to Columbia.

Pre-engineering GPA: The pre-engineering GPA will be calculated by Columbia and consist of all courses listed in the Guide below *with the exception* of the English Composition, Economics, and 27 non-technical course requirements as well as laboratory courses with separate grades (for consistency across grading systems).

Minimum B grade: This **only applies to students who entered the affiliate in fall 2011 or later**. The minimum B grade is for all courses listed in the Guide below *with the exception* of the English Composition, Economics, and 27 non-technical course requirements.

Prerequisite coursework: All prerequisite courses must be listed on the home institution's transcript, regardless if they were taken at another institution. Additionally, all courses not taken at the home institution should be *approved by the liaison*.

All courses taken at the affiliate institution: This **only applies to students who entered the affiliate in fall 2011 or later** and refers to **all** prerequisite courses listed in this guide. Please note the following:

AP/IB or other advanced credit from high school: We will accept any advanced high school credit providing that **the credit for this clearly appears on the home institution's transcript and it is approved by the liaison**.

Placement Exams: If a student has taken a placement exam and has placed out of a prerequisite course, the **liaison must certify this knowledge and approve the placement and placement should appear on the transcript**. Please note that Columbia reserves the right to have a student demonstrate this knowledge and/or retake the course.

Courses at other institutions: If for some reason *as approved by the liaison* a student cannot take a prerequisite course at the home institution, the student may take the class at a **two- or four-year institution, in person and in the United States**. The liaison **must approve this course** and the course must **appear on the home institution's transcript**. Students are required to **submit all transcripts**.

Degree and major requirement completion: Degree requirements are courses, as listed in the home institution's course catalog, that are required to obtain a degree from the home institution. Major requirements are courses, as listed in the home institution's course catalog, that are required to complete a major or primary course of study from the home institution. Only one major or primary course of study must be completed for guaranteed admission. Additionally, please note that this requirement does **not** mean that a student must complete the full number of course credits required for the degree (e.g., the full 128 credits). The home institution will accept course credits from Columbia to complete this degree, as Columbia will use a blanket 68 incoming credits towards the Columbia degree upon enrollment at Columbia. Also, 3-2 candidates should not that they cannot receive their degree from the home institution until the two years at Columbia are successfully completed.

Science instructor: This recommendation letter should come from an instructor of an academic course in the sciences. It should not be a leader of a discussion section or laboratory section.

Math instructor: This recommendation letter should come from an instructor of an academic course in mathematics. It should not be a leader of a discussion section.

English language proficiency: This **only applies to students who entered the affiliate in fall 2011 or later**. If English is not the native language, students should **review our website by November 1** to see the most up-to-date Columbia policy for English language proficiency.

2013-2014 PRE-ENGINEERING PREREQUISITE COURSES

We require each Combined Plan affiliate to develop a curriculum guide that outlines the specific courses at that institution which fulfill our prerequisites; those courses are listed in this guide. **Liaisons at each school** are responsible for determining which classes fulfill Columbia pre-engineering prerequisite courses.

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

FOUNDATION COURSES REQUIRED OF ALL MAJORS:

- i. MATHEMATICS
 - ❑ The **full sequence** of Calculus I, II, III, IV (V1101, V1102, V1201, V1202).
- ii. PHYSICS
 - ❑ Mechanics and Thermodynamics (C1401)
 - ❑ Electricity, Magnetism, and Optics (C1402)
- iii. CHEMISTRY
 - ❑ General Chemistry I (C1403)
 - 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 a one-semester physics lab or one-semester chemistry lab is generally required and may be taken in conjunction with the introductory Physics and/or Chemistry courses listed above.*
- v. COMPUTER SCIENCE
 - ❑ Introduction to computer science and programming in C++, JAVA, Python or MATLAB (W1003, W1004, W1005, W1007 or W1009)
 - Some majors require a specific programming language (see requirements for majors below).*
- vi. HUMANITIES AND SOCIAL SCIENCES
 - ❑ Principles of Economics (ECON W1105)
 - ❑ English Composition (ENGL C1010 University Writing)
 - ❑ 27 non-technical credit hours. These courses are often fulfilled through **major** and **degree** requirements; students should speak with their liaison(s) to ensure they have fulfilled this requirement.

REQUIRED MAJOR SPECIFIC COURSES

(Notes in *italics* clarify requirements.)

APPLIED MATHEMATICS or APPLIED PHYSICS

MATHEMATICS

- ❑ Ordinary Differential Equations (E1210)

PHYSICS

- ❑ Classical and Quantum Waves (C1403)
- ❑ Physics Lab (C1493/4)

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

- ❑ General Chemistry I (C1403)
- ❑ Environmental Biology: Molecules to Cells (EEEE W2001)
- ❑ Introduction to Molecular and Cellular Biology (C2005)

BIOMEDICAL ENGINEERING (ALL TRACKS)

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.*
- ❑ Introduction to Statistics (with Calculus) (STAT W1211) [*may be taken the summer before entering or while at Columbia*]

PHYSICS

- ❑ Classical and Quantum Waves (C1403)

CHEMISTRY

- ❑ General Chemistry II (C1404)
- ❑ General Chemistry Lab (C1500)
- ❑ Organic Chemistry I (C3443)

ELECTRICAL ENGINEERING

- ❑ Introduction to Electrical Engineering (ELEN E1201) [*may be taken the summer before entering or while at Columbia*]

ENGINEERING MECHANICS

- ❑ Mechanics (ENME E3105) [*may be taken the summer before entering or while at Columbia*]

COMPUTER SCIENCE

Introduction to Computer Science and Programming in MATLAB (COMS W1005) preferred

CHEMICAL ENGINEERING

MATHEMATICS (*choose one course listed below*)

- ❑ Ordinary Differential Equations (E1210)
- ❑ Introduction to applied mathematics – Ordinary Differential Equations & Linear Algebra (APMA E2101)

PHYSICS

- ❑ Physics Lab (C1493/4)

CHEMISTRY

- ❑ General Chemistry II (C1404)
- ❑ General Chemistry Lab (C1500)
- ❑ Organic Chemistry I (C3443)
- ❑ Organic Chemistry Lab (C3543)

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 (C1493/4)
- ❑ General Chemistry Lab (C1500)

ENGINEERING MECHANICS

- ❑ Mechanics (ENME E3105) [*may be taken the summer before entering or while at Columbia*]

COMPUTER SCIENCE

Introduction to Computer Science and Programming in MATLAB (COMS W1005) preferred

COMPUTER 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 (C1493/4)
- ❑ General Chemistry Lab (C1500)

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

- ❑ Discrete Mathematics (COMS W3203)

ELECTRICAL ENGINEERING

- ❑ Introduction to Electrical Engineering (ELEN E1201) [*may be taken the summer before entering or while at Columbia*]

COMPUTER SCIENCE

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

- ❑ Physics Lab (C1493/4)
- ❑ General Chemistry Lab (C1500)

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

- ❑ Data Structures and Algorithms (COMS W3137)
- ❑ Discrete Mathematics (COMS W3203)

EARTH AND ENVIRONMENTAL 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.

CHEMISTRY

- ❑ General Chemistry II (C1404)
- ❑ General Chemistry Lab (C1500)

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

- ❑ Organic Chemistry (CHEM C3443)
- ❑ Classical & quantum waves (PHYS C1403)
- ❑ Introduction to Molecular and Cellular Biology (BIOL C2005)

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

- ❑ Advanced General Geology (EESC W4001) [*may be taken while at Columbia.*]
- ❑ The Climate System (EESC V2100) [*may be taken while at Columbia.*]
- ❑ The Solid Earth System (EESC V2200) [*may be taken while at Columbia.*]

EARTH AND ENVIRONMENTAL ENGINEERING

- ❑ Alternative Energy Resources (EAEE E2002) [*may be taken at Columbia*]

ELECTRICAL 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

- ❑ Classical and Quantum Waves (C1403)
- ❑ Physics Lab (C1493/4)

COMPUTER SCIENCE

Computer Programming in JAVA (W1007) is recommended.

ELECTRICAL ENGINEERING

- ❑ Introduction to Electrical Engineering (ELEN E1201) [*may be taken the summer before entering or while at Columbia*]

IEOR: ENGINEERING MANAGEMENT SYSTEMS

MATHEMATICS (*choose one course listed below*)

- Linear Algebra (MATH V2010 or APAM E3101)

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

- Physics Lab (C1493/4)
- General Chemistry Lab (C1500)

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

- Computer Programming in C (W1003)
 - Data Structures in C (W3133)
- or-
- Computer Programming in JAVA (W1007)
 - Data Structures in JAVA (W3134)

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

ECONOMICS

- Introduction to Accounting and Finance (E2261)

PROBABILITY AND STATISTICS

- Introduction to Probability and Statistics (W3600)

*Please note that the course must have calculus as a prerequisite. 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 extremely competitive. Students who are interested in this major should consider the Operations Research, Industrial Engineering or Engineering Management Systems which are housed in the same department (IEOR) as Financial Engineering.

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 (C1493/4)
- General Chemistry Lab (C1500)

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

- Computer Programming in C (W1003)
- Data Structures in C (W3133)
- or-
- Computer Programming in JAVA (W1007)
- Data Structures in JAVA (W3134)

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

ECONOMICS

- Introduction to Accounting and Finance (E2261)

PROBABILITY AND STATISTICS

- Introduction to Probability and Statistics (W3600)

*Please note that the course must have calculus as a prerequisite. The Department ***strongly*** suggests taking two separate courses: one in Probability and one in Statistics.*

IEOR: OPERATIONS RESEARCH

MATHEMATICS

- Linear Algebra (MATH V2010 or APAM E3101)

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

- Physics Lab (C1493/4)
- General Chemistry Lab (C1500)

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

- Computer Programming in C (W1003)
- Data Structures in C (W3133)
- or-
- Computer Programming in JAVA (W1007)
- Data Structures in JAVA (W3134)

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

ECONOMICS

- Introduction to Accounting and Finance (E2261)

PROBABILITY AND STATISTICS

- Introduction to Probability and Statistics (W3600)

*Please note that the course must have calculus as a prerequisite. The Department ***strongly*** suggests taking two separate courses: one in Probability and one in Statistics.*

ENGINEERING MECHANICS

MATHEMATICS

- ❑ Ordinary Differential Equations (E1210)

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

- ❑ Physics Lab (C1493/4)
- ❑ General Chemistry Lab (C1500)

ENGINEERING MECHANICS

- ❑ Mechanics (ENME E3105) [*may be taken the summer before entering or while at Columbia*]
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MATERIALS SCIENCE AND ENGINEERING

MATHEMATICS

- ❑ Ordinary Differential Equations (E1210)

PHYSICS

- ❑ Classical and Quantum Waves (C1403)
- ❑ Physics Lab (C1493/4)

CHEMISTRY

- ❑ General Chemistry II (C1404)
 - ❑ General Chemistry Lab (C1500)
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MECHANICAL 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/ BIOLOGY (*choose one course listed below*)

- ❑ Classical and Quantum Waves (PHYS C1403)
- ❑ Environmental Biology: Molecules to Cells (EEEE W2001)
- ❑ Introduction to Molecular and Cellular Biology (C2005)

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

- ❑ Physics Lab (C1493/4)
- ❑ General Chemistry Lab (C1500)

ENGINEERING MECHANICS

- ❑ Mechanics (ENME E3105) [*may be taken while at Columbia*]

ELECTRICAL ENGINEERING

- ❑ Intro. to Electrical Engineering (ELEN E1201) or equivalent [*may be taken while at Columbia*]
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