

## 2012-13 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 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.

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

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.

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

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.

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.

# 2012-2013 PRE-ENGINEERING PREREQUISITE COURSES

In order to be considered for guaranteed admission, you must successfully complete the equivalents of the following Columbia courses (code numbers given in parentheses) at your 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.** All prerequisites must be noted on an official transcript, with an official grade and credit received for that course; if you have taken the course at another institution, you **must send a copy of that school's transcript.**

Please note: for students who enter an affiliate after fall 2011, each prerequisite course must be taken at the affiliate institution; otherwise Columbia reserves the right to determine if the requirements have been met. Any prerequisite courses waived by the member institution through AP, equivalency or individual testing must be clearly noted as such in the materials accompanying the application.

## 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; please speak with your liaison to ensure that you 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 (EEEEB W2001)
- ❑ Introduction to Molecular and Cellular Biology (C2005)

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## 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)
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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 (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

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## 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]
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## 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)
  - ❑ Scientific Computation (COMS W3210)
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## 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]
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## 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.

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## 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 prerequisite requirements:

MATHEMATICS

- ❑ Linear Algebra (MATH V2010 or APAM E3101)
- ❑ Ordinary Differential Equations (MATH V1210)

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.

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## ECONOMICS

- ❑ Introduction to Accounting and Finance (E2261)

## PROBABILITY AND STATISTICS

- ❑ Probability (IEOR E3658)
- ❑ Statistical Inference (W3659)

Please note that the course must have calculus as a prerequisite.

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## 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.

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## 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.

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## 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)

## 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 (EEEB 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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