PRE - COMBINED PLAN CURRICULUM GUIDE for University of Richmond students

In order to be considered for guaranteed admission, students must have a GPA of 3.3 or above and a minimum B letter grade to all Foundation Courses and Major Specific Courses. The student must have also successfully complete the equivalents of the required Columbia courses at University of Richmond (UR). You should touch base with the UR liaison (Dr. Ovidiu Lipan, (804) 287 6670 or olipan@richmond.edu) in order to determine other ways to fulfill prerequisites if UR does not offer a required course listed in this guide.

For more information, please visit Columbia’s website at: http://www.studentaffairs.columbia.edu/admissions/engineering/combined or e-mail them at combinedplan@columbia.edu.

Foundation Courses required of all Majors:

i. MATHEMATICS
   • The full sequence of Calculus I, II, III, IV (MATH 211/212 or 231/232, and 235)

ii. PHYSICS
   • Introductory Physics with Calculus and Physics Lab I or Integrated Science/Math/Computer Science 2 with Laboratory - Mechanics and Thermodynamics (PHYS 127 or 191 or 131)
   • Introductory Physics with Calculus and Physics Lab II - Electricity, Magnetism, and Optics (PHYS 132 or 133 or 134)

iii. CHEMISTRY
   • General Chemistry I or Integrated Science/Math/Computer Science 2 with Laboratory (CHEM 141 or 191)

   Some programs require a second semester of General Chemistry. Please see individual programs below for details.

iv. LAB REQUIREMENT
   CHEM and PHYS classes listed above are taking care of the one-semester physics lab or one-semester chemistry lab requirement.

v. COMPUTER SCIENCE
   • Introduction to Computing or Scientific Computing (CMSC 150 or CMSC 155)
   Some majors require a specific programming language other than C++. Please see individual programs below for details.

vi. HUMANITIES AND SOCIAL SCIENCES
   • Twenty-seven credit hours nontechnical requirement is satisfied by the course work taken as general education requirement for the bachelor’s degree awarded by UR. Please speak with the UR liaison in regards to which courses fulfill this requirement.
   Among these courses the students must include:
     o Principles of Economics (ECON 101)
     o English Composition (FYS)
**Major Specific Requirements:**

**NOTE:** Some courses are not available at University of Richmond but may be available at schools we have exchange programs with or may be taken during summer at another institution. Courses not taken at UR must be pre-approved.

**APPLIED MATHEMATICS OR APPLIED PHYSICS**

**MATHEMATICS**
- Differential Equations (MATH 312)

**PHYSICS**
- Modern Physics (PHYS 205)
- Introductory Physics with Calculus and Physics Lab I and II or Integrated Science/Math/Computer Science 2 with Laboratory (PHYS 127 or 191 or 131 and PHYS 132 or 133 or 134)

**CHEMISTRY/BIOLOGY (choose one of the courses listed below)**
- General Chemistry with Lab or Integrated Science/Math/Computer Science 2 with Laboratory (CHEM 141 or 191)
- BIOL 199 Introduction to Biological Thinking or BIOL 190 Integrated Science/Math/Computer Science 1 with Laboratory (BIOL199 or 190)
- Genetics and Cellular Biology (BIOL 201 and BIOL 205)

**BIOMEDICAL ENGINEERING (ALL TRACKS)**

**MATHEMATICS**
- Differential Equations (MATH 312)
- Linear Algebra (MATH 245)

**PHYSICS**
- Modern Physics (PHYS 205)

**CHEMISTRY**
- Inorganic Chemistry with Lab (CHEM 317)
- Organic Chemistry I (CHEM 205)

**ELECTRICAL ENGINEERING**
- Intro. to Electrical Engineering (not offered at UR; may be taken the summer before or during the first semester at Columbia)

**ENGINEERING MECHANICS**
- Mechanics (not offered at UR; may be taken the summer before or during the first semester at Columbia)

**COMPUTER SCIENCE**
- Introduction to Computer Science and Programing in MATLAB preferred. (CMSC 155)
CHEMICAL ENGINEERING

MATHEMATICS
- Differential Equations (MATH 312)
- Linear Algebra (MATH 245)

PHYSICS/ CHEMISTRY LAB (choose one of the courses listed below)
- Introductory Physics with Calculus and Physics Lab I and II or Integrated Science/Math/Computer Science 2 with Laboratory (PHYS 127 or 191 or 131 and PHYS 132 or 133 or 134)

CHEMISTRY
- Inorganic Chemistry with Lab (CHEM 317)
- Organic Chemistry with Lab (CHEM 205)

CIVIL ENGINEERING

MATHEMATICS
- Differential Equations (MATH 312)
- Linear Algebra (MATH 245)

PHYSICS/ CHEMISTRY LAB (choose one of the courses listed below)
- Introductory Physics with Calculus and Physics Lab I and II or Integrated Science/Math/Computer Science 2 with Laboratory (PHYS 127 or 191 or 131 and PHYS 132 or 133 or 134)
- General Chemistry with Lab or Integrated Science/Math/Computer Science 2 with Laboratory (CHEM 141 or 191)

ENGINEERING MECHANICS
- Mechanics *(may be taken the summer before or during the first semester at Columbia)*

COMPUTER SCIENCE
- Introduction to Computer Science and Programming in MATLAB preferred. (CMSC 155)

COMPUTER ENGINEERING

MATHEMATICS
- Ordinary Differential Equations (MATH 312)
- Linear Algebra (MATH 245)

PHYSICS/ CHEMISTRY LAB (choose one of the courses listed below)
- Introductory Physics with Calculus and Physics Lab I and II or Integrated Science/Math/Computer Science 2 with Laboratory (PHYS 127 or 191 or 131 and PHYS 132 or 133 or 134)
- General Chemistry with Lab or Integrated Science/Math/Computer Science 2 with Laboratory (CHEM 141 or 191)
COMPUTER SCIENCE
- Discrete Structures for Computing (CMSC 222)

ELECTRICAL ENGINEERING
- Intro. to Electrical Engineering or equivalent (not offered at UR; may be taken the summer before or during the first semester at Columbia)

COMPUTER SCIENCE

PHYSICS/ CHEMISTRY LAB (choose one of the courses listed below)
- Introductory Physics with Calculus and Physics Lab I and II or Integrated Science/Math/Computer Science 2 with Laboratory (PHYS 127 or 191 or 131 and PHYS 132 or 133 or 134)
- General Chemistry with Lab or Integrated Science/Math/Computer Science 2 with Laboratory (CHEM 141 or 191)

COMPUTER SCIENCE
- Data Structures with Lab (CMSC 221)
- Discrete Structures for Computing (CMSC 222)
- Numerical Analysis (CMSC 328)

MATHEMATICS
- Differential Equations (MATH 312)
- Linear Algebra (MATH 245)

CHEMISTRY
- Inorganic Chemistry with Lab (CHEM 317)

OTHER SCIENCE ELECTIVE (choose one of the courses listed below)
- Organic Chemistry (CHEM 205)
- Modern Physics (PHYS 205)
- Genetics and Cellular Biology (BIOL 201 and BIOL 205)

EARTH AND ENVIRONMENTAL SCIENCES (choose one of the courses listed below)
- Advanced General Geology
- The Climate System
- The Solid Earth System
(not offered at UR; may be taken the summer before or during the first semester at Columbia)

EARTH AND ENVIRONMENTAL ENGINEERING
- Alternative Energy Resources (not offered at UR; may be taken the summer before or during the first semester at Columbia)
ELECTRICAL ENGINEERING

MATHEMATICS
- Differential Equations (MATH 312)
- Linear Algebra (MATH 245)

PHYSICS
- Modern Physics (PHYS 205)
- Introductory Physics with Calculus and Physics Lab I and II or Integrated Science/Math/Computer Science 2 with Laboratory (PHYS 127 or 191 or 131 and PHYS 132 or 133 or 134)

COMPUTER SCIENCE
- Data Structures with Lab and Software Systems Development (CMSC 221 and CMSC 240)

ELECTRICAL ENGINEERING
- Intro to Electrical Engineering or equivalent (not offered at UR; may be taken the summer before or during the first semester at Columbia)

IEOR: ENGINEERING MANAGEMENT SYSTEMS

MATHEMATICS
- Linear Algebra (MATH 245)

PHYSICS/ CHEMISTRY LAB (choose one of the courses listed below)
- Introductory Physics with Calculus and Physics Lab I and II or Integrated Science/Math/Computer Science 2 with Laboratory (PHYS 127 or 191 or 131 and PHYS 132 or 133 or 134)
- General Chemistry with Lab or Integrated Science/Math/Computer Science 2 with Laboratory (CHEM 141 or 191)

COMPUTER SCIENCE
- Introduction to Computer Science and Programming (CMSC 155)
- Data Structures with Lab (CMSC 221)

ECONOMICS
- Fundamentals of Financial Accounting and Principles of Financial Management (ACCT 201 and FIN 360)

PROBABILITY AND STATISTICS
- Mathematical Statistics (MATH 330 or BUAD 201)
- Probability (MATH 329)

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 (MATH 245)
- Differential Equations (MATH 312)

**PHYSICS/ CHEMISTRY LAB** (choose one of the courses listed below)
- Introductory Physics with Calculus and Physics Lab I and II or Integrated Science/Math/Computer Science 2 with Laboratory (PHYS 127 or 191 or 131 and PHYS 132 or 133 or 134)
- General Chemistry with Lab or Integrated Science/Math/Computer Science 2 with Laboratory (CHEM 141 or 191)

**COMPUTER SCIENCE**
- Introduction to Computer Science and Programming (CMSC 155)
- Data Structures with Lab (CMSC 221)

**ECONOMICS**
- Fundamentals of Financial Accounting and Principles of Financial Management (ACCT 201 and FIN 360)

**PROBABILITY AND STATISTICS**
- Mathematical Statistics (MATH 330 or BUAD 201)
- Probability (MATH 329)

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**IEOR: INDUSTRIAL ENGINEERING**

**MATHEMATICS**
- Linear Algebra (MATH 245)

**PHYSICS/ CHEMISTRY LAB** (choose one of the courses listed below)
- Introductory Physics with Calculus and Physics Lab I and II or Integrated Science/Math/Computer Science 2 with Laboratory (PHYS 127 or 191 or 131 and PHYS 132 or 133 or 134)
- General Chemistry with Lab or Integrated Science/Math/Computer Science 2 with Laboratory (CHEM 141 or 191)

**COMPUTER SCIENCE**
- Introduction to Computer Science and Programming (CMSC 155)
- Data Structures with Lab (CMSC 221)

**ECONOMICS**
- Fundamentals of Financial Accounting and Principles of Financial Management (ACCT 201 and FIN 360)

**PROBABILITY AND STATISTICS**
- Mathematical Statistics (MATH 330 or BUAD 201)
• Probability (MATH 329)

IEOR: OPERATIONS RESEARCH

MATHEMATICS
• Linear Algebra (MATH 245)

PHYSICS/ CHEMISTRY LAB (choose one of the courses listed below)
• Introductory Physics with Calculus and Physics Lab I and II or Integrated Science/Math/Computer Science 2 with Laboratory (PHYS 127 or 191 or 131 and PHYS 132 or 133 or 134)
• General Chemistry with Lab or Integrated Science/Math/Computer Science 2 with Laboratory (CHEM 141 or 191)

COMPUTER SCIENCE
• Introduction to Computer Science and Programming (CMSC 155)
• Data Structures with Lab (CMSC 221)

ECONOMICS
• Fundamentals of Financial Accounting and Principles of Financial Management (ACCT 201 and FIN 360)

PROBABILITY AND STATISTICS
• Mathematical Statistics (MATH 330 or BUAD 201)
• Probability (MATH 329)

ENGINEERING MECHANICS

MATHEMATICS
• Differential Equations (MATH 312)

PHYSICS/ CHEMISTRY LAB (choose one of the courses listed below)
• Introductory Physics with Calculus and Physics Lab I and II or Integrated Science/Math/Computer Science 2 with Laboratory (PHYS 127 or 191 or 131 and PHYS 132 or 133 or 134)
• General Chemistry with Lab or Integrated Science/Math/Computer Science 2 with Laboratory (CHEM 141 or 191)

ENGINEERING MECHANICS
• Mechanics (not offered at UR; may be taken the summer before or during the first semester at Columbia)

MATERIALS SCIENCE AND ENGINEERING

MATHEMATICS
• Differential Equations (MATH 312)
PHYSICS
- Introductory Physics with Calculus and Physics Lab I and II or Integrated Science/Math/Computer Science 2 with Laboratory (PHYS 127 or 191 or 131 and PHYS 132 or 133 or 134)
- Modern Physics (PHYS 205)

CHEMISTRY
- General Chemistry with Lab or Integrated Science/Math/Computer Science 2 with Laboratory (CHEM 141 or 191)
- Inorganic Chemistry (CHEM 317)

MECHANICAL ENGINEERING

MATHEMATICS
- Linear Algebra (MATH 245)
- Differential Equations (MATH 312)

PHYSICS/ BIOLOGY (choose one of the courses listed below)
- Modern Physics (PHYS 205)
- Environmental Biology: Molecules to Cells (BIOL199 or BIOL 190)
- Introduction to molecular and Cellular Biology (BIOL 201 and BIOL 205)

PHYSICS/ CHEMISTRY LAB (choose one of the courses listed below)
- Introductory Physics with Calculus and Physics Lab I and II or Integrated Science/Math/Computer Science 2 with Laboratory (PHYS 127 or 191 or 131 and PHYS 132 or 133 or 134)
- General Chemistry with Lab or Integrated Science/Math/Computer Science 2 with Laboratory (CHEM 141 or 191)

ENGINEERING MECHANICS
- Mechanics (not offered at UR; may be taken the summer before or during the first semester at Columbia)

ELECTRICAL ENGINEERING
- Intro to Electrical Engineering or equivalent (not offered at UR; may be taken the summer before or during the first semester at Columbia)