

# **THE ROLLINS COLLEGE**

## **PRE-ENGINEERING PROGRAM**

**A GUIDE FOR STUDENTS AND ADVISORS  
2017-2018**

**COOPERATIVE AGREEMENTS WITH**

- **AUBURN UNIVERSITY**
- **CASE WESTERN RESERVE UNIVERSITY**
- **COLUMBIA UNIVERSITY**
- **WASHINGTON UNIVERSITY in ST. LOUIS**

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### **THE COOPERATIVE PRE-ENGINEERING PLAN**

Do I want a degree in the liberal arts and sciences or engineering? Why not pursue both and open up new career possibilities?

Rollins College provides students with the opportunity to combine a three-year, well-rounded program in the liberal arts and sciences with two years of professional academic work in engineering at one of the cooperative institutions. Students who successfully complete the program receive the Bachelor of Arts degree from Rollins and the Bachelor of Science degree from the cooperative engineering program.

Why spend five years, rather than four years, earning an engineering degree? Many large universities already require more than four years to complete the engineering degree. Pre-Engineering students bring a diversity of knowledge that allows them to solve more complex problems in more creative ways than the average engineering student. The additional time spent broadening their educational experience in the arts, social sciences, and humanities allows pre-engineering students to find wide-ranging careers compared to the average engineering student.

Furthermore, in-depth study in the natural and mathematical sciences (beyond the core requirements) provides students with a scientific background, which better prepares them for a career in engineering. Perhaps the greatest advantage of the cooperative pre-engineering plan is that it affords students the opportunity to explore a number of academic disciplines, while at the same time preparing for a potential career in engineering. The program of study during the first two years is compatible with that of students majoring in mathematics, physics, or chemistry. In addition, after one year, a student can decide to pursue a major in the arts, social sciences, or humanities and still complete all degree requirements for the Rollins BA within four years.

## **DEGREE REQUIREMENTS**

In order to receive the BA degree in pre-engineering from Rollins College, students must complete a set of core requirements in the sciences and mathematics, satisfy the general education requirements of the College, complete an approved area of concentration within one of the established majors offered by the College, and complete a total of at least 105 semester hours during the three years at Rollins. In addition, students must successfully complete at least 35 semester hours at one of the cooperating institutions.

To earn the BS degree from one of the cooperating institutions, students must satisfy all the degree requirements of the engineering school. These requirements are normally met by the end of the fifth year of study. It is very important for students to understand that they cannot stay at Rollins for four years and major in pre-engineering. In order to satisfy the requirements of this program they must complete at least 35 hours of study at one of the cooperative engineering schools.

## **PROGRAM OF STUDY**

### **Area of Concentration**

Each student must complete an area of concentration approved by the Coordinator of the Cooperative Pre-Engineering Program. These concentrations are normally quite similar to a minor in the field and usually are in one of the following areas: physics, chemistry, mathematics, or computer science. Although other areas are possible, it is difficult for the student to complete a sufficient number of courses in a three-year period unless some of the introductory courses in the area of concentration are also included in the core requirements. The required courses in the approved areas of concentration can be seen below:

**Physics**

PHY 130 Principles of Physics I  
PHY 131 Principles of Physics II  
PHY 220 Mathematical Methods for Physical Sciences I  
PHY 221 Mathematical Methods for Physical Sciences II  
PHY 230 Modern Physics  
PHY 232 Experimental Physics II  
PHY 250 Thermodynamics  
PHY 308 Mechanics  
PHY 314 Electricity and Magnetism

**Chemistry**

CHM 120 Chemistry I  
CHM 121 Chemistry II  
CHM 220 Organic Chemistry I  
CHM 221 Organic Chemistry II  
CHM 305 Physical Chemistry I  
CHM 306 Physical Chemistry II  
plus two approved courses in chemistry at the 300 or 400 level.

**Mathematics**

MAT 111 Calculus I  
MAT 112 Calculus II  
MAT 140 Introduction to Discrete Mathematics  
MAT 211 Calculus III  
MAT 219 Probability and Statistics  
MAT 230 Linear Algebra  
MAT 305 Ordinary Differential Equations  
One additional course in mathematics at the 300 or 400 level.

**Computer Science**

MAT 140 Introduction to Discrete Mathematics  
MAT 310 Applied Discrete Mathematics  
CMS 167 Introduction to Computer Programming  
CMS 170 Computer Science Principles I  
CMS 230 Introduction to Computer Systems  
CMS 270 Computer Science Principles II  
CMS 330 System Software Principles

The choice of the area of concentration will depend on a student's interests. For example, students interested in pursuing mechanical engineering, electrical engineering, civil engineering, or materials science and engineering would normally choose physics. Students interested in chemical engineering should definitely concentrate in chemistry, since both organic chemistry and physical chemistry are required in these programs. A student interested in computer engineering would concentrate in computer science and a student interested in biomedical engineering might concentrate in chemistry and

supplement this with B120-121, General Biology. A student interested in systems science and mathematics or operations research would normally concentrate in mathematics, while students interested in industrial engineering might choose mathematics or physics and supplement the program with courses in economics and business.

## **CORE REQUIREMENTS**

1. Mathematics (5 courses)  
MAT 111- 112 Calculus I and II  
MAT 211 Calculus III  
MAT 230 Linear Algebra  
MAT 305 Ordinary Differential Equations

Or

MAT 111- 112 Calculus I and II  
PHY 220 and PHY 221

2. Physics (4 courses)  
PHY 130 Principles of Physics I  
PHY 131 Principles of Physics II  
PHY 230 Modern Physics  
PHY 232 Experimental Physics II
3. Chemistry (2 courses)  
CHM 120 Chemistry I  
CHM 121 Chemistry II
4. Computer Programming (1 course)  
CMS167A & B Intro to Computer Programming

Or

PHY 325 Computational Physics

## **GENERAL EDUCATION REQUIREMENTS**

In addition to completing the General Education requirements of Rollins College, pre-engineering students must also satisfy any general education requirements of the cooperative engineering program to which they intend to apply. It is important to plan the elective and general education courses taken at Rollins College, in order to satisfy as many of the cooperative program-specific general education requirements as possible.

The cooperative program general education requirements are listed below:

- **Auburn University**
  1. Two courses in English composition. May be satisfied by taking ENG 140 and ENG 300.
  2. Twelve (12) total hours in Humanities
    - Must include :
      - A. At least one course in literature
      - B. At least one course in fine arts
  3. Twelve (12) total hours in Social Sciences
    - Must include:
      - A. At least one course in world history
  
- **Case Western Reserve**
  1. Twenty-one (21) semester hours in Humanities and Social Sciences
  2. One English composition course
  
- **Columbia University**
  1. At least 27 semester hours in the humanities and social sciences, which must include:
    - A. One semester of principles of economics
    - B. One semester of English composition
  
- **Washington University in St. Louis**
  1. Fifteen semester hours in the humanities and social sciences. This sequence must include at least two courses in humanities, at least two courses in the social sciences.
  2. English composition: One course, acceptable examination scores, or college certification of proficiency.

For additional information on these requirements, the student should meet with the Pre-Engineering program Coordinator.

## **The First Two Years**

Students selecting an area of concentration in physics or mathematics will need to begin with calculus in the fall term of their first-year. Students selecting chemistry, or other areas of concentration, may delay calculus until the sophomore year, but they should do so only if it is necessary for them to complete pre-calculus mathematics before beginning the calculus sequence. The standard sequence of courses used to satisfy the core requirements is given below:

## First Year

### Fall

PHY 130  
MAT 111  
RCC  
Elective

### Spring

PHY 131  
MAT 112  
ENG 140  
Elective

## Second Year

### Fall

CHM 120  
PHY 230  
MAT 211 or PHY 220  
\_\_\_\_ Elective

### Spring

CHM 121  
PHY 232  
MAT 305 or PHY 221  
Elective

1. Students who have had AP Physics and AP calculus in high school and have done well in their AP exams in those subjects, with consent, may be able to start their physics and calculus studies at the sophomore level.

## ENGINEERING DISCIPLINES

There is a wide variety of engineering disciplines available to students through the three cooperating institutions. The descriptions of and requirements for these programs are given at the three university Web sites. Studying the requirements of these programs should help students in the selection of their area of concentration, as well as their elective courses. A list of these disciplines by institution is given below:

- **Auburn University** (<http://eng.auburn.edu/programs/index.html>)
  - Aerospace Engineering
  - Chemical Engineering
  - Materials Engineering
  - Industrial and Systems Engineering
  - Electrical & Computer Engineering
  - Computer Science & Software Engineering
  - Biosystems Engineering
  - Civil Engineering
  - Mechanical Engineering
  - Wireless Engineering
- **Case Western Reserve**
  - Biomedical Engineering
  - Civil Engineering
  - Electrical Engineering
  - Materials Science
  - Systems & Control Engineering
  - Chemical Engineering
  - Computer Engineering
  - Macromolecular Science
  - Mechanical & Aerospace Engineering

- **Columbia University** (<http://www.engineering.columbia.edu/bulletin/>)
 

Biomedical Engineering	Chemical Engineering
Computer Science	Electrical Engineering
Materials Science	Mechanical Engineering
Computer Engineering	
Industrial Engineering & Operations Research	
Civil Engineering & Engineering Mechanics	
Earth & Environmental Engineering	
  
- **Washington University in St. Louis** (<http://engineering.wustl.edu/>)
  - Biomedical Engineering
  - Computer Science & Engineering
  - Electrical & Systems Engineering
  - Energy, Environmental & Chemical Engineering
  - Mechanical Engineering & Materials Science

## **APPLICATION PROCEDURE**

Students should begin the application procedure for admission to engineering school early in the fall term of their junior year. The deadlines for receipt of materials vary by institution, but in general, we encourage students, especially those interested in financial aid, to submit their applications by the end of the fall term.

The minimum grade-point average required for admission will vary by engineering program. Case Western Reserve and Auburn require a minimum 3.0 GPA overall and in science and mathematics courses. Washington University in St. Louis requires a 3.25 GPA, while Columbia University requires an overall 3.3 GPA and a 3.3 GPA in pre-engineering required courses. Most applicants have a GPA substantially above these minima. To initiate the application procedure, students should contact the Coordinator of the Cooperative Pre-Engineering Program. Students are, in general, encouraged to apply to more than one institution.

## **GRADUATE ENGINEERING**

In addition to the programs leading to the BS degree, there are several programs that allow a student to also earn a masters degree within a total period of six years. Students interested in graduate engineering may major in any field, but must complete the same core requirements of the cooperative pre-engineering program.

The School of Engineering and Applied Science at Columbia offers a 4-2 option in which

a student graduating from Rollins with a BA degree and a cumulative grade point average of 3.3 or better (3.5 or better for electrical engineering) may be admitted to the Master of Science degree program. To qualify for this program, students must have completed the core requirements of the cooperative pre-engineering program as well as the general education requirements of Columbia University, within their four-year program of study at Rollins. The two-year program at Columbia usually will require the student to take undergraduate engineering courses as prerequisites for graduate courses. Since this option does not provide the student with all the courses in the BS curriculum, it is not recommended for those who wish to practice as professional engineers. In general, it is possible for any student to complete the MS degree in one additional year of study beyond the BS degree in engineering. Thus, cooperative pre-engineering students can complete a BA degree from Rollins and the BS and MS degrees from the engineering school in a total of six years under the normal cooperative plan.

Washington University in St. Louis offers a plan by which a student may complete the BA degree from Rollins, the BS degree in engineering and an engineering Master's degree on a 3-3 or 4-3 schedule. For details on all of these options, see the Coordinator of the Cooperative Pre-Engineering Program.