

| ELECTRICAL ENGINEERING PROGRAM: FIRST AND SECOND YEARS<br>EARLY-STARTING STUDENTS |                                                                                                                                                                                                                                                                                                              |                                            |                                                                                                                   |                                                                                                                  |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
|                                                                                   | SEMESTER I                                                                                                                                                                                                                                                                                                   | SEMESTER II                                | SEMESTER III                                                                                                      | SEMESTER IV                                                                                                      |
| MATHEMATICS                                                                       | MATH UN1101 (3)                                                                                                                                                                                                                                                                                              | MATH UN1102 (3)                            | APMA E2000 (4) and E2001 (0) either semester                                                                      |                                                                                                                  |
|                                                                                   |                                                                                                                                                                                                                                                                                                              |                                            |                                                                                                                   | and APMA E2101 (3) <sup>1</sup>                                                                                  |
| PHYSICS<br>(three sequences,<br>choose one)                                       | UN1401 (3)<br>UN1601 (3.5)<br>UN2801 (4.5)                                                                                                                                                                                                                                                                   | UN1402 (3)<br>UN1602 (3.5)<br>UN2802 (4.5) |                                                                                                                   |                                                                                                                  |
| CHEMISTRY                                                                         | one-semester lecture<br>(3–4)<br>UN1403 or UN1404 or<br>UN2045 or UN1604                                                                                                                                                                                                                                     |                                            |                                                                                                                   |                                                                                                                  |
| CORE REQUIRED COURSES                                                             | ELEN E1201 (3.5)<br>Introduction to electrical engineering<br>(either semester)                                                                                                                                                                                                                              |                                            | ELEN E3201 (3.5)<br>Circuit analysis<br><br>ELEN E3801 (3.5)<br>Signals and systems                               | ELEN E3331 (3)<br>Electronic circuits<br><br>CSEE E3827 (3)<br>Fund. of computer sys.                            |
| REQUIRED LABS                                                                     |                                                                                                                                                                                                                                                                                                              |                                            | ELEN E3081 (1) <sup>2</sup><br>Circuit analysis lab<br><br>ELEN E3084 (1) <sup>2</sup><br>Signals and systems lab | ELEN E3083 (1) <sup>2</sup><br>Electronic circuits lab<br><br>ELEN E3082 (1) <sup>2</sup><br>Digital systems lab |
| UNIVERSITY WRITING                                                                | CC1010 (3) either semester                                                                                                                                                                                                                                                                                   |                                            |                                                                                                                   |                                                                                                                  |
| REQUIRED NONTECHNICAL ELECTIVES                                                   | HUMA CC1001, COCI CC1101, or Global Core (3–4); HUMA UN1121 or UN1123 (3); HUMA CC1002, COCI CC1102, or Global Core (3–4); ECON UN1105 (4) and UN1155 recitation (0); some of these courses can be postponed to the junior or senior year, to make room for taking the above electrical engineering courses. |                                            |                                                                                                                   |                                                                                                                  |
| COMPUTER SCIENCE                                                                  | ENGI E1006 (3) either semester <sup>3</sup>                                                                                                                                                                                                                                                                  |                                            |                                                                                                                   |                                                                                                                  |
| PHYSICAL EDUCATION                                                                | UN1001 (1)                                                                                                                                                                                                                                                                                                   | UN1002 (1)                                 |                                                                                                                   |                                                                                                                  |
| THE ART OF ENGINEERING                                                            | ENGI E1102 (4) either semester                                                                                                                                                                                                                                                                               |                                            |                                                                                                                   |                                                                                                                  |

<sup>1</sup> APMA E2101 may be replaced by MATH UN2030 (formerly MATH E1210) and either APMA E3101 or MATH UN2010.

<sup>2</sup> If possible, these labs should be taken along with their corresponding lecture courses.

<sup>3</sup> ENGI E1006 may not be offered every semester. See [ee.columbia.edu](http://ee.columbia.edu) for more discussion about the Computer Science sequences.

| ELECTRICAL ENGINEERING: THIRD AND FOURTH YEARS<br>EARLY-STARTING STUDENTS |                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                 |                                                                                                        |                                                          |
|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
|                                                                           | SEMESTER V                                                                                                                                                                                                                                                                    | SEMESTER VI                                                                                                                                                                                                                                                                     | SEMESTER VII                                                                                           | SEMESTER VIII                                            |
| <b>PHYSICS<br/>(sequences<br/>continued)</b>                              | UN1403 (3)<br>UN2601 (3.5)<br>Lab W3081 (2)                                                                                                                                                                                                                                   | Lab UN1494 (3) <sup>1</sup>                                                                                                                                                                                                                                                     |                                                                                                        |                                                          |
| <b>EE CORE<br/>REQUIRED<br/>COURSES</b>                                   | ELEN E3106 (3.5)<br>Solid-state devices and<br>materials                                                                                                                                                                                                                      | ELEN E3401 (4)<br>Electromagnetics<br><br>ELEN E3701 (3) <sup>2</sup><br>Intro. to<br>communication systems<br><b>or</b><br>CSEE W4119 (3) <sup>2</sup><br>Computer networks                                                                                                    |                                                                                                        |                                                          |
| <b>EE REQUIRED LABS</b>                                                   |                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                 | ELEN E3043 (3)<br>Solid state, microwave,<br>and fiber optics lab<br><br>ELEN E3399 (1)<br>EE practice | ELEN E3390 (3) <sup>3</sup><br>Capstone design<br>course |
| <b>OTHER REQUIRED<br/>COURSES</b>                                         | IEOR E3658 <b>or</b> STAT GU4203 <sup>4</sup> ; <b>and</b> COMS W3136 ( <b>or</b> W3134 or W3137) <sup>5</sup><br>(some of these courses <i>are not</i> offered both semesters. Students with an adequate<br>background can take some of these courses in the sophomore year) |                                                                                                                                                                                                                                                                                 |                                                                                                        |                                                          |
| <b>ELECTIVES</b>                                                          | <b>EE DEPTH<br/>TECH</b>                                                                                                                                                                                                                                                      | At least two technical electives in one depth area. The four depth areas are<br>(a) photonics, solid-state devices, and electromagnetics; (b) circuits and electronics;<br>(c) signals and systems; and (d) communications and networking<br>(for details, see ee.columbia.edu) |                                                                                                        |                                                          |
|                                                                           | <b>BREADTH<br/>TECH</b>                                                                                                                                                                                                                                                       | (at least 6 points total)<br>At least two technical electives outside the chosen depth area; must be courses with significant<br>engineering content<br>(see ee.columbia.edu)                                                                                                   |                                                                                                        |                                                          |
|                                                                           | <b>OTHER TECH</b>                                                                                                                                                                                                                                                             | Additional technical electives (consisting of more depth or breadth courses, or further options listed at<br>ee.columbia.edu/ee-undergraduate-program) as required to bring the total points of technical electives to 18 <sup>6</sup>                                          |                                                                                                        |                                                          |
|                                                                           | <b>NONTECH</b>                                                                                                                                                                                                                                                                | Complete 27-point requirement; see page 9 (27-Point Nontechnical Requirement)                                                                                                                                                                                                   |                                                                                                        |                                                          |
| <b>TOTAL POINTS<sup>7</sup></b>                                           | 16.5                                                                                                                                                                                                                                                                          | 17                                                                                                                                                                                                                                                                              | 16                                                                                                     | 18                                                       |

<sup>1</sup> Chemistry lab (CHEM UN1500) may be substituted for physics lab, although this is not generally recommended.

<sup>2</sup> These courses can be taken in the sophomore year if the prerequisites/corequisites are satisfied.

<sup>3</sup> The capstone design course provides ELEN majors with a "culminating design experience." As such, it should be taken near the end of the program and involve a project that draws on material from a range of courses. If special arrangements are made in ELEN E3399, it is possible to use courses such as ELEN E3998, E4350, E4998, EECS E4340, or CSEE W4840 in place of ELEN E3390.

<sup>4</sup> SIEO W3600 and STAT GU4001 cannot generally be used to replace IEOE E3658 or STAT GU4203.

<sup>5</sup> Students who plan to minor in Computer Science should choose COMS W3134 or W3137.

<sup>6</sup> The total points of technical electives is reduced to 15 if APMA E2101 has been replaced by MATH UN2030 (formerly MATH E1210) and either APMA E3101 or MATH UN2010. Combined-plan students with good grades in separate, advanced courses in linear algebra and ODEs can also apply for this waiver, but the courses must have been at an advanced level for this to be considered.

<sup>7</sup> "Total points" assumes that 20 points of nontechnical electives and other courses are included.

| ELECTRICAL ENGINEERING PROGRAM: FIRST AND SECOND YEARS<br>LATE-STARTING STUDENTS |                                                                          |                                            |                                                                                          |                                                                                                          |
|----------------------------------------------------------------------------------|--------------------------------------------------------------------------|--------------------------------------------|------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
|                                                                                  | SEMESTER I                                                               | SEMESTER II                                | SEMESTER III                                                                             | SEMESTER IV                                                                                              |
| <b>MATHEMATICS</b>                                                               | MATH UN1101(3)                                                           | MATH UN1102 (3)                            | APMA E2000 (4) and E2001 (0) either semester                                             |                                                                                                          |
|                                                                                  |                                                                          |                                            |                                                                                          | and APMA E2101 (3) <sup>1</sup>                                                                          |
| <b>PHYSICS</b><br>(three sequences,<br>choose one)                               | UN1401 (3)<br>UN1601 (3.5)<br>UN2801 (4.5)                               | UN1402 (3)<br>UN1602 (3.5)<br>UN2802 (4.5) | UN1403 (3)<br>UN2601 (3.5)<br>Lab UN3081 (2)                                             | Lab UN1494 (3) <sup>2</sup>                                                                              |
| <b>CHEMISTRY</b>                                                                 | one-semester lecture<br>(3–4)<br>UN1403 or UN1404 or<br>UN2045 or UN1604 |                                            |                                                                                          |                                                                                                          |
| <b>ELECTRICAL<br/>ENGINEERING</b>                                                | ELEN E1201 (3.5) either semester <sup>3</sup>                            |                                            |                                                                                          |                                                                                                          |
| <b>UNIVERSITY<br/>WRITING</b>                                                    | CC1010 (3) either semester                                               |                                            |                                                                                          |                                                                                                          |
| <b>REQUIRED<br/>Nontechnical<br/>Electives</b>                                   |                                                                          |                                            | HUMA CC1001,<br>COCI CC1101,<br>or Global Core (3–4)<br><br>HUMA UN1121 or<br>UN1123 (3) | HUMA CC1002,<br>COCI CC1102,<br>or Global Core (3–4)<br><br>ECON UN1105 (4) and<br>UN1155 recitation (0) |
| <b>COMPUTER<br/>SCIENCE</b>                                                      | ENGI E1006 (3) any semester <sup>4</sup>                                 |                                            |                                                                                          |                                                                                                          |
| <b>PHYSICAL<br/>EDUCATION</b>                                                    | UN1001 (1)                                                               | UN1002 (1)                                 |                                                                                          |                                                                                                          |
| <b>THE ART OF<br/>ENGINEERING</b>                                                | ENGI E1102 (4) either semester                                           |                                            |                                                                                          |                                                                                                          |

<sup>1</sup> APMA E2101 may be replaced by MATH UN2030 (formerly MATH E1210) and either APMA E3101 or MATH UN2010.

<sup>2</sup> Chemistry lab (CHEM UN1500) may be substituted for physics lab, although this is not generally recommended.

<sup>3</sup> Transfer students and 3-2 Combined Plan students who have not taken ELEN E1201 prior to the junior year are expected to have taken a roughly equivalent course when they start ELEN E3201.

<sup>4</sup> ENGI E1006 may not be offered every semester. See ee.columbia.edu for more discussion about the Computer Science sequences.

| ELECTRICAL ENGINEERING: THIRD AND FOURTH YEARS<br>LATE-STARTING STUDENTS |                                                                                                                                                                                        |                                                                                                                                                                                                                                                                          |                                                                                                     |                                                       |
|--------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------|
|                                                                          | SEMESTER V                                                                                                                                                                             | SEMESTER VI                                                                                                                                                                                                                                                              | SEMESTER VII                                                                                        | SEMESTER VIII                                         |
| <b>EE CORE<br/>REQUIRED<br/>COURSES</b>                                  | ELEN E3106 (3.5)<br>Solid-state devices and materials<br><br>ELEN E3201 (3.5)<br>Circuit analysis<br><br>ELEN E3801 (3.5)<br>Signals and systems                                       | CSEE W3827(3)<br>Fund. of computer sys.<br><br>ELEN E3331 (3)<br>Electronic circuits<br><br>ELEN E3401 (4)<br>Electromagnetics<br><br>ELEN E3701 (3)<br>Intro. to communication systems<br><b>or</b><br>CSEE W4119 (3)<br>Computer networks                              |                                                                                                     |                                                       |
| <b>EE REQUIRED LABS</b>                                                  | ELEN E3081 (1) <sup>1</sup><br>Circuit analysis lab<br><br>ELEN E3084 (1) <sup>1</sup><br>Signals and systems lab                                                                      | ELEN E3083 (1) <sup>1</sup><br>Electronic circuits lab<br><br>ELEN E3082 (1) <sup>1</sup><br>Digital systems lab                                                                                                                                                         | ELEN E3043 (3)<br>Solid state, microwave, and fiber optics lab<br><br>ELEN E3399 (1)<br>EE practice | ELEN E3390 (3) <sup>2</sup><br>Capstone design course |
| <b>OTHER REQUIRED COURSES</b>                                            | IEOR E3658 <b>or</b> STAT GU4203 <sup>3</sup> ; <b>and</b> COMS W3136 ( <b>or</b> W3134 <b>or</b> W3137) <sup>4</sup><br>(Some of these courses are <i>not</i> offered both semesters) |                                                                                                                                                                                                                                                                          |                                                                                                     |                                                       |
| <b>ELECTIVES</b>                                                         | <b>EE DEPTH TECH</b>                                                                                                                                                                   | At least two technical electives in one depth area. The four depth areas are (a) photonics, solid-state devices, and electromagnetics; (b) circuits and electronics; (c) signals and systems; and (d) communications and networking. (For details, see ee.columbia.edu.) |                                                                                                     |                                                       |
|                                                                          | <b>BREADTH TECH</b>                                                                                                                                                                    | (at least 6 points total)<br>At least two technical electives outside the chosen depth area; must be courses with significant engineering content (see ee.columbia.edu)                                                                                                  |                                                                                                     |                                                       |
|                                                                          | <b>OTHER TECH</b>                                                                                                                                                                      | Additional technical electives (consisting of more depth or breadth courses, or further options listed at ee.columbia.edu/ee-undergraduate-program) as required to bring the total points of technical electives to 18 <sup>5</sup>                                      |                                                                                                     |                                                       |
|                                                                          | <b>NONTECH</b>                                                                                                                                                                         | Complete 27-point requirement; see page 9 (27-Point Nontechnical Requirement)                                                                                                                                                                                            |                                                                                                     |                                                       |
| <b>TOTAL POINTS<sup>6</sup></b>                                          | 15.5                                                                                                                                                                                   | 18                                                                                                                                                                                                                                                                       | 16                                                                                                  | 18                                                    |

*Note:* This chart shows one possible schedule for a student who takes most of their major program in the final two years. Please refer to the previous chart for a recommended earlier start.

<sup>1</sup> If possible, these labs should be taken along with their corresponding lecture courses.

<sup>2</sup> The capstone design course provides ELEN majors with a "culminating design experience." As such, it should be taken near the end of the program and involve a project that draws on material from a range of courses. If special arrangements are made in ELEN E3399, it is possible to use courses such as ELEN E3998, E4350, E4998, EECS E4340, or CSEE W4840 in place of ELEN E3390.

<sup>3</sup> SIEO W3600 and STAT GU4001 cannot generally be used to replace IEOE E3658 or STAT GU4203.

<sup>4</sup> Students who plan to minor in Computer Science should choose COMS W3134 or W3137.

<sup>5</sup> The total points of technical electives is reduced to 15 if APMA E2101 has been replaced by MATH UN2030 (formerly MATH E1210) and either APMA E3101 or MATH UN2010. Combined-plan students with good grades in separate, advanced courses in linear algebra and ODEs can also apply for this waiver, but the courses must have been at an advanced level for this to be considered.

<sup>6</sup> "Total points" assumes that 9 points of nontechnical electives are included.