# APPROVED TECHNICAL ELECTIVES FOR ELECTRICAL ENGINEERS

You are required to complete eighteen (18 or 19) semester credit hours of Technical Electives. You need 19 credits if your CORE Electives total 6 credits (EE 321 and EE 332).

- Twelve (12 or 13) credits of electives must be from the lists of EE/CprE electives below, **including one approved sequence.**
- The remaining six (6) credits required can be chosen from the lists of EE/CprE or Non-EE/CprE technical electives.

Courses not on these lists may be counted as technical electives only if approved by the ECpE Curriculum Committee. A written request must be submitted and approved **before** the course is taken. For 500-level Technical Elective options, see your academic adviser. **NO Graduate or Undergraduate Seminars** are allowed for Technical Elective credit. Graduate Special Topics courses require ECpE Curriculum Committee review.

### IMPORTANT NOTATIONS (Please Read):

1. @ EE 422 and EE 423 must be take at the same time.
2. * Course is cross-listed (same course). Can only apply one towards graduation EE, CprE, SE, or ComS.
3. ✔ Will need to check "Schedule of Classes" at http://classes.iastate.edu/ for class availability.
4. Math 489 & ME 484 are not allowed as EE or Non-EE Technical Electives - They can be used as a general education course.
5. ENGR/EE/CprE 467, EE 442 & EE 448 **cannot** be used to fulfill any elective requirements.
6. EE 351 and EE 388 may be used to fulfill International Perspective requirements - You must choose if you want the course applied to either a general education OR technical elective requirement but not both
7. Only one course of the following sets of courses may be applied as a technical elective: either MatE273 or MatE392; either ComS207 or ComS227; either ComS208 or ComS 228.
8. ComS 227 may be used either to fulfill the EE 285 course requirement OR applied to technical elective credit, but not both.
9. Only Math 207 or Math 317 can apply toward graduation requirements, not both courses.
10. ENV S 324 (cross-listed with ENSCI, GEOL, MTEOR) -You must choose if you want the course applied to either a general education OR technical
11. A maximum of 2 credits of EE/CprE/SE 490, Independent Study can be applied towards technical electives

## LIST OF APPROVED SEQUENCES

**Need to have one approved sequence**

**The semester the courses are offered may change**

| COURSES | DESCRIPTION | SEM | CR | PREREQUISITES (Check latest catalog for complete lists) |
|---|---|---|---|---|
| **ELECTROMAGNETIC, FIELDS, ANTENNAS AND PROPAGATION (SELECT TWO)** | | | | |
| EE 414 | Microwave Engineering | F | 4 | EE 311, EE 230 |
| EE 417 | Electromgntc Radiation, Antennas & Prop | S | 4 | EE 311 |
| *EE/CprE 418 | High Speed Syst Engr Msrmnt & Test | F | 4 | EE 230, EE 311 |
| **COMMUNICATIONS (SELECT ALL THREE FOR SEQUENCE)** | | | | |
| EE 321 | Communication Systems I | F | 3 | EE 224 |
| EE 422@ | Communication Systems II | S | 3 | EE 321, EE 423+ |
| EE 423@ | Communication Systems Lab | S | 1 | EE 321, EE 422+ |
| **ANALOG/DIGITAL ELECRONICS (EE 330 cannot be technical elective, but is required for this sequence)** | | | | |
| *EE/CprE 435 w/EE/CprE 330 | Analog VLSI Circuit Design | S | 4 | EE 324, EE 330, EE 332 & EE 322 or Stat 330 |
| (or) | | | | |
| *EE/CprE 465 w/EE/CprE 330 | Digital VLSI Design | F | 4 | EE 330 |
| **SEMICONDUCTOR DEVICES (SELECT TWO)** | | | | |
| EE 432 | Microelectronics Fabrication Techniques | S | 4 | Phys 222, Math 267, EE 332 or MatE 334 |
| EE 438 | Optoelectronic Devices & Applications | S | 3 | EE 311, EE 332 |
| EE 439 | Nanoelectronics | F | 3 | EE 332 or MatE 331 |
| **POWER SYSTEMS (SELECT EE 456 AND ONE OTHER FOR SEQUENCE)** | | | | |
| EE 456 | Power Systems Analysis I | F | 3 | EE 303, Co-req EE 324 |
| and EE 455 | Intro to Energy Distribution Systems | ✔ | 3 | EE 303, Co-req EE 324 |
| or EE 457 | Power Systems Analysis II | S | 3 | EE 303, Co-req EE 324 |
| or EE 458 | Econ Systms for Electrical Pwr Planning | ✔ | 3 | EE 303 or Econ 301 |

| COURSES | DESCRIPTION | SEM | CR | PREREQUISITES (Check latest catalog for complete lists) |
|---|---|---|---|---|
| **LINEAR SYSTEMS** | | | | |
| EE 475 | Automatic Control Systems | F | 3 | EE 324 |
| EE 476 | Control Systems Simulation | S | 3 | EE 475 |
| **COMPUTER ENGINEERING (SELECT 381 AND ONE OTHER FOR SEQUENCE)** | | | | |
| CprE 381 | Computer Org & Assembly Lvl Prgming | F/S | 4 | CprE 288 |
| CprE 308 | Operating Systems: Principles & Practice | F/S | 4 | CprE 381, CprE 310 |
| CprE 388 | Embedded Systems II: Mobile Platforms | ✔ | 4 | CprE 288 |
| **BIOMEDICAL ENGINEERING** | | | | |
| EE/BME 341X | BioMEMS and Nanotechnology | ✔ | 3 | BME 220, |
| EE/BME 450 | Biosensing | ✔ | 3 | BME 220 |

**Note:** *BIOL 212, EE 185 or equiv, Math 166, Chem 167 or 178, Phys 222 are prereqs to BME 220*

## OTHER APPROVED EE/CPRE COURSES

### These courses cannot be used to fulfill sequence requirements

**The semester the courses are offered may change**

| | | | | |
|---|---|---|---|---|
| **SIGNALS & SYSTEMS** | | | | |
| EE 324 | Signals and Systems II | F/S | 4 | EE 224 |
| EE 489X | Survey of Remote Sensor Networks | S | 3 | 4 courses in physical, biological sciences, or engineering |
| **COMMUNICATIONS** | | | | |
| EE 323 | Intro to Digital Signal Processing | S | 4 | EE 224 |
| **POWER SYSTEMS** | | | | |
| EE 452 | Electrical Machines & Pwr Electronic Dr | S | 3 | EE 303, EE 324 |
| EE 459 | Electrom. Wind Energy Conv. & Grid Integ. | ✔ | 3 | Co-req EE 452, EE 456 |
| **SEMICONDUCTOR DEVICES** | | | | |
| EE 333X | Electronic Systems Design | F | 4 | EE 230, Co-req CprE 288 |
| EE 437X | Electronic Properties of Materials | S | 3 | EE 332 or Phys 322 |
| **INDEPENDENT STUDY** (ONLY 2 CREDITS OF EE 490 CAN APPLY TO TECH ELECTIVES & BSEE DEGREE) | | | | |
| EE 490 (see notation) | Independent Study | F/S/SS | 1-2 | Senior Classification |
| **COMPUTING & NETWORKING SYSTEMS** | | | | |
| CprE 310 | Theoretical Foundations of Cpr Engr. | F/S | 3 | Co-req CprE 288, ComS 228 |
| CprE 450 | Distributed Systems & Middleware | S | 3 | CprE 308 or ComS 352 |
| CprE/ComS 454 | Distributed & Ntwk Operating Systems | S | 3 | ComS 311, ComS 352 |
| CprE 488 | Embedded Systems Design | F/S | 4 | CprE 381 or ComS 321 |
| CprE 489 | Cpr. Ntwking and Data Communications | F/S | 4 | CprE 381 or EE 324 |
| **SECURE & RELIABLE COMPUTING** | | | | |
| CprE 431 | Basics of Information Systems Security | S | 3 | Co-req CprE 489 or ComS 454 |
| **SOFTWARE SYSTEMS** | | | | |
| CprE/ComS 425 | High Perform Cmpting for Sci & Engr App | S | 3 | ComS 311, ComS 330 |
| CprE/ComS 444 | Introduction to Bioinformatics | F | 4 | Math 165 or Stat 401 or equivalent |
| CprE 458 | Real Time Systems | F | 3 | CprE 308 or ComS 352 |
| **SOFTWARE ENGINEERING** | | | | |
| *SE/ComS 319 | Software Construction & User Interface | F | 3 | ComS 228 |
| *CprE/SE 329 | Software Project Management | S | 3 | ComS 309 |
| *CprE/SE 339 | Software Architechure & Design | ✔ | 3 | SE 319 |
| *SE/ComS 409 | Software Requirements Engr | F | 3 | ComS 309 |
| SE/Com S/CprE 412 | Formal Methods in Software Engr | S | 3 | Com S 330 or Cpr E 310, Com S 311, Stat 330 |
| *CprE/SE 416 | Software Evolution and Maintenance | ✔ | 3 | ComS 309 |
| *SE/ComS 417 | Software Testing | S | 3 | ComS 309, ComS 319 |

| | | | | |
|---|---|---|---|---|
| *CprE/SE 419X | Software Tools for Large Scale Data Analysis | S | 4 | CPR E 308 or COM S 352, COM S 309 |

| COURSES | DESCRIPTION | SEM | CR | PREREQUISITES (Check latest catalog for complete lists) |
|---|---|---|---|---|
| **INTERDISCIPLINARY/ OTHER COURSES** | | | | |
| CprE 315 (not offered) | Application of Algorithms in Computer Engr. | ✔ | 3 | CprE 310 |
| *CprE/EE 466 | Multidisciplinary Engineering Design | F/S | 3 | Senior classification, within 2 semesters of graduation |
| EE 351 | Analysis of Energy Systems | ✔ | 3 | Phys 222 |
| EE 388 (see notation) | Sustainable Engineering & Int'l Devlmt | F | 3 | Junior Classification in Engineering |
| EE 488 | Eddy Current Nondestructive Evaluation | ✔ | 3 | Math 265 and MatE 216 or 272 or EE 311 or Phys 364 |
| EE 489X | Survey of Remote Sensing Technologies | S | 3 | 4 courses physical or biological sciences or engineering |
| EE 496 | Modern Optics | S | 3 | Co-req Phys 322, Phys 365, Phys 480 |

## NON-EE/CPRE ELECTIVES

**The semester the courses are offered may change**

EE students may select up to six credits of Non-EE/CprE Electives from 300- and 400-level courses open for nonmajor graduate credit (see catalog) in the following areas: Computer Science, Mathematics, Physics, and other Engineering departments (e.g. ConE 380 or EM 351). for Math 317--see notation #9. **The courses listed below are approved exceptions to these guidelines.**

| COURSES | DESCRIPTION | SEM | CR | PREREQUISITES (Check latest catalog for complete lists) |
|---|---|---|---|---|
| BME 220 | Introduction to Biomedical Engineering | S | 3 | Biol 212, ENGR 160 or equiv, Math 166, Chem 167 or 178, Phys 222 |
| Biol 211 | Principles of Biology I | F/S | 3 | HS Biol |
| Biol 211L | Principles of Biology I Lab | F/S | 1 | Credit or enrollment in Biol 211 |
| Biol 212 | Principles of Biology II | F/S | 3 | HS Biol; HS Chem or Cr/E in Chem 163/177 |
| Biol 212L | Principles of Biology II Lab | F/S | 1 | Credit or enrollment in Biol 212 |
| ComS 207 (see notation) | Fundamentals of Computer Programming | F/S | 3 | Math 150 or placement in Math 140/141/142 or higher |
| ComS 208 (see notation) | Intermediate Computer Programming | F/S | 3 | Coms 207, Co-req Math 151, 160, or 165 |
| ComS 227 (see notation) | Introduction to Object-Oriented Programming | F/S | 4 | None |
| ComS 228 (see notation) | Introduction to Data Structures | F/S | 3 | ComS 227 with C- or better, Co-req Math 165 |
| ComS 229 (now ComS 327) | Advanced Programming Techniques | F/S | 3 | ComS 228, Co-req Math 166 |
| ComS 252 | Linux Operating System Essentials | F | 3 | ComS 107 or ComS 207 or ComS 227 |
| ConE 241 | Construction Materials & Methods | F/S | 3 | ConE 222 |
| EE 391 | Open Laboratory and Design Studio | F | 2 | **junior classification (only approved for non-EE tech elec** |
| EM 274 | Statics of Engineering | F/S/SS | 3 | Co-req Math 166, Co-req Phys 111 or Phys 221 |
| Engr 340 | Intro to Wind Energy: Syst Dsgn & Delvry | ✔ | 3 | Math 166, Phys 222 |
| ENV S 324 (see notation) | Energy & The Environment | S | 3 | |
| MatE 215 | Intro to Materials Science & Engr | F/S | 3 | Chem 167 or Chem 177, Math 165 |
| MatE 273 (see notation) | Principles of Materials Science & Engr | F/S/SS | 3 | Chem 167 or Chem 177, Math 165, Sophomore |
| MatE 392 (see notation) | Principles of Materials Science & Engr | SS | 3 | MatE 391, Chem 167 or Chem 177 |
| ME 231 | Engineering Thermodynamics I | F/S/SS | 3 | Math 265, Chem 167, Phys 222 |
| NS 320 | Naval Ship Systems I: Engineering | F | 3 | NROTC students only - Phys 221, Sophomore |
| NS 330 | Naval Ship Systems II: Weapons | S | 3 | NROTC students only - Phys 221, Sophomore |