College of Engineering

The Klipsch School of

Electrical and Computer Engineering

BSEE REQUIREMENTS

2019-2020, Rev 1

Electrical Engineering Program Educational Objectives

The Klipsch School is dedicated to providing a quality, hands-on, educational experience for our students. Below are the program educational objectives (PEOs) that describe the expected accomplishments of graduate during their first few years after graduation.

1. Our graduates will obtain relevant, productive employment in the private sector, government and/or pursue an advanced degree.
2. Our graduates will be using their engineering foundation to innovate solutions to the problems of the real world.

This document presents a summary of the requirements for earning a Bachelor of Science degree in Electrical Engineering (BSEE) from New Mexico State University (NMSU). It is intended as a guide, and is in no way meant to replace or amend the 2019-2020 Undergraduate Catalog.

Catalog Selection: The requirements outlined below are specific to the 2019-2020 catalog and may be different from those of other catalogs. The requirements set forth in the 2019-2020 catalog are in effect from the beginning of the 2019 summer term until the end of the 2024 spring term. Students graduating after their catalog of matriculation has expired may meet the requirements of any catalog in effect at the time of graduation. Note, however, that changing catalogs may render classes already taken inapplicable toward graduation. Always check with an advisor before deciding to change catalogs.

Departmental Responsibilities: The Klipsch School is responsible for:

1. Providing current lists of approved elective courses for each category. The lists of approved electives are subject to change at any time. To ensure proper course selection, when registering be sure to use an up-to-date list available at ece.nmsu.edu
2. Assisting students in curriculum planning, selection of electives, and scheduling. Each semester, before registering for classes, all undergraduate students must be advised or mentored. The department office maintains a list of mentor assignments.

Student Responsibilities: *It is the responsibility of each student to ensure that all the requirements for graduation have been met.* In general, each student is responsible for:

1. Following all university regulations, as listed in the 2019-2020 NMSU Catalog. The catalog is the ultimate authority when it comes to regulations, this BSEE REQUIREMENTS handout is merely a summary of the information specific to Electrical Engineering students.
2. Following all college requirements, as listed in the 2019-2020 NMSU catalog. A few of the college requirements are highlighted below:
	1. **Students must earn a grade of C- or better in all** engineering, technology, math and science **courses** **required** for the degree and also courses taken to satisfy the general education requirements for Area I-Communications, Area II-Mathematics/Algebra, and Area III-Laboratory Science. If a grade lower than C- is earned in any of these courses, the student is required to retake the course immediately during the next semester it is offered.
	2. An undergraduate student may attempt an engineering, math, or physical science course no more than three times to earn a passing grade of C- or better. Anytime a student earns less than a C-, a meeting with the appropriate Engineering academic advisor is required to develop a plan for addressing this issue. If the student fails to pass any of these courses **after three attempts**, then the student will not be able to continue as an Engineering major and will be counseled on other degree options.
3. Following all departmental requirements, as listed in the 2019-2020 NMSU catalog. In particular, be aware that elective choices must be made such that:
	1. The selected course is a **currently** approved elective in the desired category.
	2. A minimum of 120 credits is completed, of which 45 must be numbered 300-499.
4. Taking courses in the proper sequence. Most courses have co- and/or prerequisites. These are listed in the course descriptions of the 2019-2020 NMSU catalog. A prerequisite **must** have been completed (**with a grade of ‘C-’, or better**) prior to enrolling in the class, while a co-requisite may be taken either at the same time, or prior to, the class. Enrolling in a class without the proper preparation is grounds for administrative removal from the course, potentially impacting on full-time status, financial aid eligibility, and/or graduation plans

Note also that some prerequisites apply universally and are not listed for individual classes. For example: the university has made ENGL 111 a prerequisite to **all** courses numbered 300-499. The college has made MATH 192 a co-requisite to all engineering courses numbered 300-499.

1. Monitoring their official NMSU email account. Each student is issued an email address in the @nmsu.edu domain. This address is used for official communication and students are responsible for all messages sent to that address.

Transfer Credit: Credit earned at other institutions is generally accepted, however:

• Engineering credit must be earned at an ABET accredited school.

• Physics must be calculus-based.

• If the NMSU requirement includes a laboratory, the transfer credit must include a lab.

• A grade of ‘C-’, or better, must have been earned.

• Cornerstone and Capstone, and EE Electives may not be transferred.

**Table 1**

BSEE Degree Requirements

2019-2020

**General Education Requirements** (41 credits)

 **State of New Mexico General Education Common Core** (35 credits) Credits

 Area I: Written Communication Two courses1 7

 Oral Communication One course1 3

 Area II: Mathematics Calculus I (MATH 191) 4

 Area III: Laboratory Science General Chemistry I2 (CHEM 111) 4

 Engineering Physics I2 (PHYS 215) 4

 Area IV: Social & Behavioral Sciences One course1 3

 Area V: Humanities One course1 3

 Area VI: Creative & Fine Arts One course1 3

 Gen. Education Elective Calculus II (MATH 192) 4

 **NMSU General Education Requirements** (6 credits)

 Viewing a Wider World Electives Two courses1,3 6

**Program Specific Requirements**(80-82 credits)

**Mathematics & Natural Science** (14 credits)

EE 200 Linear Algebra, Probability and Statistics Applications2 4

EE 240 Multivariate and Vector Calculus Applications 3

MATH 392 Differential Equations 3

PHYS 216 and PHYS 216L Engineering Physics II2 4

**Engineering** (59-61 credits)

ENGR 100 Introduction to Engineering 3

EE 100 Introduction to Electrical and Computer Engineering2 4

EE 112 Embedded Systems2 4

EE 212 Introduction to Computer Architecture and Organization2 4

EE 230 Circuit Analysis and Introduction to Electronics2 4

EE 300 Cornerstone Design4 2

EE 317 Semiconductor Devices and Electronics2,4 4

EE 320 Signals and Systems I4 3

EE 325 Signals and Systems II2,4 4

EE 333 AC Circuit Analysis and Introduction to Power Systems2,4 3

EE 340 Fields and Waves2,4 4

EE 402 or ENGR 401 Capstone Design I4 3

EE 404 or ENGR 402 Capstone Design II4 3

EE Concentration Courses (Four courses from Table 2)4 12 or 13

Two STEM Electives (Two courses from Table 4)3 6

Object-Oriented Programming (One course from Table 3) 3 or 4

TOTAL 121 - 123

Notes:

1. See the 2019-2020 Undergraduate Catalog for course lists and details.
2. Including laboratory.
3. Three 300+ courses (9 credits) in one specific subject count as a VWW course for that subject. Commonly, E E students take upper division MATH or C S courses as STEM Electives. For that reason, it is advised NOT to take a VWW course from the College of Arts and Sciences, at least until all STEM Electives are chosen.
4. Transfer credit not accepted for all E E courses numbered 300 and above.

**Table 2 Electrical and Computer Engineering Concentrations**

Select One Concentration Area or No Concentration

Completed Concentration will be Appear on Transcript and Diploma

The sub-fields of Communications and Signal Processing, Computers and Microelectronics, Control and Power, and Electromagnetics and Photonics are significant areas within the broader field of electrical engineering. This concentration give students the opportunity to specialize by a suitable choice of junior/senior elective courses. The goal is to enhance prospects for employment and/or graduate study.

**Communications and Signal Processing (12 credits)**

Required (3 cr each):

EE 395 Introduction to Digital Signal Processing

EE 496 Introduction to Communications Systems

Choose two such that at least one has EE prefix (3 cr each):

|  |  |
| --- | --- |
| EE 444 Advanced Image ProcessingEE 446 Digital Image Processing EE 447 Neural Signal ProcessingEE 460 Space System Design, AnalysisEE 469 Communications Networks EE 497 Digital Communication Systems I C S 343 Algorithm Design & ImplementationC S 372 Data Structures and Algorithms (4 cr)C S 453 Python Programming I C S 475 Artificial Intelligence I C S 476 Computer Graphics I  | C S 477 Digital Game DesignC S 478 Computer SecurityC S 483 Introduction to RoboticsC S 486 BioinformaticsMATH 471 Complex VariablesMATH 472 Fourier Series, Boundary Value ProbMATH 473 Calculus of Variations, Optimal CntrlMATH 480 Matrix Theory, Appl. Lin. AlgebraMATH 481 Advanced Linear AlgebraMATH 491 Introduction to Real Analysis I STAT 470 Probability: Theory & Applications |

**Computers and Microelectronics (12 credits)**

Required (3 cr each):

EE 462 Computer Systems Architecture

EE 480 Introduction to Analog and Digital VLSI

Choose two such that at least one has EE prefix (3 cr each):

|  |  |
| --- | --- |
| EE 412 ASIC DesignEE 425 Introduction to Semiconductor DevicesEE 432 Power ElectronicsEE 443 Mobile Application Development EE 458 Hardware Security and TrustEE 467 ARM SOC DesignEE 469 Communications Networks EE 482 Electronics II EE 485 Analog VLSI Design CHME 467 Nanoscience and Nanotechnology | C S 343 Algorithm Design & Implementation C S 370 Compilers and Automata Theory (4 cr)C S 371 Software Development (4 cr)C S 372 Data Structures and Algorithms (4 cr)C S 453 Python Programming IC S 474 Operating Systems IC S 478 Computer SecurityC S 480 Linux System AdministrationC S 481 Visual ProgrammingC S 482 Database Management Systems IC S 491 Parallel Programming |

Table 2 continues on next page.

**Table 2 (Cont’d)**

**Control and Power (12 credits)**

Required (4 cr each):

EE 431 & EE 431L Power Systems II

EE 493 Power Systems III

Choose two such that at least one has EE prefix (3 cr each):

|  |  |
| --- | --- |
| EE 432 Power Electronics EE 475 Automatic Control SystemsEE 476 Computer Control Systems C S 343 Algorithm Design & ImplementationC S 483 Introduction to Robotics  | CHME 361 Engineering MaterialsM E 481 Alternative and Renewable Energy M E 487 MechatronicsMATH 480 Matrix Theory, App. Linear Algebra |

**Electromagnetics and Photonics (14 credits)**

Required (7 credits):

EE 454 Antennas and Radiation (4 cr)

EE 473 Introduction to Optics (3 cr)

Choose two such that at least one has EE prefix (3 cr each):

|  |  |
| --- | --- |
| EE 425 Introduction to Semiconductor DevicesEE 449 Smart Antennas EE 452 Introduction to Radar EE 453 Microwave Engineering EE 478 Fundamentals of Photonics (4 cr) EE 479 Lasers and Applications (4 cr) CHME 311 Engineering Data Analysis | CHME 467 Nanoscience and Nanotechnology M E 328 Engineering Analysis IIASTR 402 Intro to Astronomical ObservationsMATH 471 Complex VariablesMATH 472 Fourier Series, Boundary Value Prob.MATH 480 Matrix Theory, App. Linear AlgebraPHYS 315 Modern PhysicsPHYS 471 Modern Experimental Optics |

**Space Systems Concentration (12 credits)**

Required (3 cr each):

EE 460 Space System Mission Design and Analysis

ASTR 402 Intro to Astronomical Observations

Choose two, such that one must be an EE course: (3 cr each):

|  |  |
| --- | --- |
| EE 395 Introduction to Digital Signal Processing EE 454 Antennas and Radiation (4 cr)EE 473 Introduction to Optics EE 478 Fundamentals of Photonics (4 cr)EE 496 Intro to Communications SystemsA E 362 Orbital Mechanics ASTR 401 Topics in Modern Astrophysics |  |

**No Concentration (12 credits total)**

One of the required courses from three different concentrations (9 credits)

A third course from Table 4, STEM Elective (3 credits)

**Table 3 Object-Oriented Programming Elective**

Select One Course (3 or 4 credits)

C S 151 C++ Programming (3 cr)

C S 152 Java Programming (3 cr)

C S 154 Python Programming II (3 cr)

C S 172 Computer Science I (Java) (4 cr)

C S 2711 Object-Oriented Programming (C++) (4 cr)

Notes:

1. Recommended elective, after completing E E 112, Embedded Systems.

**Table 4 STEM Electives**

Select One Course (3 credits)

1. Any additional 300+ course in E E from Table 2
2. Any 300+ in A E, C E, CHME, I E, M E (see Exception List below)
3. Any 300+ in ASTR, BIOL, CHEM, C S, MATH, PHYS, STAT (see Exception List below)

STEM Elective Exception List (Courses NOT allowed as STEM Electives)

C E/CHME/E E/E T/I E/M E 330 Environmental Management Seminar I

CHME 430 Environmental Management Seminar II

C E 355V1 Technology and the Global Environment

CHME 395V1 Brewing Science and Society

ASTR 301V1 Revolutionary Ideas in Astronomy

ASTR 305V1 The Search for Life in the Universe

ASTR 308V1 Into the Final Frontier

ASTR 330V1 Planetary Exploration

CHEM 310V1 Chemistry and Society

C S 450 2 C Programming

C S 451 C++ Programming (similar to C S 151)

C S 452 Java Programming (similar to C S 152)

C S 460-469 … Transition (courses intended for C S graduate students only)

C S 4732 Architectural Concepts I

C S 4842 Computer Networks I

C S 4942 Introduction to Smart Grids

E E 490 4 Special Topics courses that are 1 credit (for Supplemental Instruction)

MATH 313 Fundamentals of Algebra and Geometry I (for math education majors)

MATH 316 Calculus with Hands-on Applications (for math education majors)

MATH 3912 Vector Analysis

MATH 3923 Introduction to Ordinary Differential Equations

MATH 411V1 Great Theorems: The Art of Mathematics

PHYS 303V1 Energy and Society in the New Millennium

PHYS 305V1 The Search for Water in the Solar System

PHYS 4732 Introduction to Optics

PHYS 4772 Fiber Optic Communication

PHYS 4782 Fundamentals of Photonics

PHYS 4792 Lasers and Applications

STAT 3712 Statistics for Engineers and Scientists I

Notes: 1. All Viewing a Wider World Courses NOT allowed

 2. Courses with similar/same content found in E E courses NOT allowed

 3. BSEE program required course

 4. E E 490 Special Topics 3 credit courses are allowed as STEM electives

**Table 5**

Co- and Pre-requisites, **(Required courses in 2019-2020 catalog in bold)**

Course Title Pre-requisites1 Pre/Co-requisites

**E E 100 Intro to Electrical & Computer Engineering MATH 190**

**E E 112 Embedded Systems E E 100**

**E E 200 Linear Algebra, Probability, Statistics Apps E E 112 and MATH 192**

**E E 212 Intro to Computer Archit. & Organization E E 100 and MATH 190 E E 112**

**E E 230 Circuit Analysis & Intro to Electronics E E 100 and MATH 192 PHYS 216**

**E E 240 Multivariate and Vector Calculus Apps E E 112 and MATH 192**

**E E 300 Cornerstone Design E E 112, E E 212 and E E 230**

**E E 317 Semicond. Devices & Electronics I E E 230 and CHEM 111**

**E E 320 Signals & Systems I E E 200 and E E 230 MATH 392**

**E E 325 Signals & Systems II E E 320 and MATH 392**

**E E 333 AC Circuit Analysis & Intro to Power Sys. E E 230**

**E E 340 Fields and Waves E E 230, E E 240, and PHYS 216**

E E 395 Introduction to Digital Signal Processing E E 325

E E 400 Undergraduate Research Consent of Instructor

**E E 402 Capstone Design I E E 300, E E 317, E E 325, E E 333 & E E 340**

**E E 404 Capstone Design II E E 300, E E 317, E E 325, E E 333, E E 340 & E E 402**

E E 412 ASIC Design E E 480

E E 425 Introduction to Semiconductor Devices E E 317and E E 340

E E 431 Power Systems II E E 333

E E 432 Power Electronics E E 317 and E E 333 E E 325

E E 443 Mobile Application Development C S 151, C S 152, C S 172, C S 271, C S 451 or C S 452

E E 444 Advanced Image Processing E E 446

E E 446 Digital Image Processing E E 395

E E 447 Neural Signal Processing E E 325

E E 449 Smart Antennas E E 325 and E E 340

E E 452 Introduction to Radar E E 325 and E E 340

E E 453 Microwave Engineering E E 340

E E 454 Antennas and Radiation E E 340

E E 458 Hardware Security and Trust E E 212

E E 460 Satellite Design Junior Standing (really PHYS 216)

E E 461 Program Management Junior Standing (recommended PHYS 216)

E E 462 Computer Systems Architecture I E E 212

E E 465 Machine Learning I E E 200

E E 467 ARM SOC Design E E 212 and E E 317

E E 469 Digital Communications Networks E E 100, E E 112 and (E E 200 or STAT 371)

E E 473 Introduction to Optics PHYS 216 or PHYS 217

E E 475 Automatic Control Systems E E 325

E E 476 Computer Control Systems E E 325

E E 478 Optical Sources, Detectors, and Radiometry PHYS 216 or PHYS 217

E E 479 Lasers and Applications E E 340 or PHYS 461

E E 480 Introduction to VLSI E E 212 and E E 317

E E 482 Electronics II E E 317

E E 485 Analog VLSI Design E E 320 and E E 480

E E 490 Selected Topics Consent of Instructor

E E 493 Power Systems III E E 333 E E 431

E E 496 Introduction to Communications Systems E E 325

E E 497 Digital Communications Systems I E E 200 and E E 325

Notes: 1. A grade of C-, or better, is required in all STEM courses for the major.

**Table 6**

Equivalent Courses between New and Old Curricula

New Curriculum (2016+ Catalog) Old Curriculum (Prior to 2016 Catalog)

Course Title Course Title .

E E 100 Introduction to Electrical & Computer Engin. E E 162 Digital Circuit Design

E E 112 Embedded Systems E E 161 Computer Aided Prob. Solving **AND**

 E E 260 Embedded Systems

E E 200 Linear Algebra, Probability, Statistics Apps E E 210 Engineering Analysis I

E E 212 Intro to Computer Archit. & Organization E E 363 Computer Systems Architecture I

E E 230 Circuit Analysis & Intro to Electronics E E 280 DC & AC Circuits

E E 240 Multivariate and Vector Calculus Apps E E 310 Engineering Analysis II

E E 300 Cornerstone Design No equivalent course

E E 317 Semiconductor Devices and Electronics E E 380 Electronics I

E E 320 Signals & Systems I E E 312 Signals & Systems I

E E 325 Signals & Systems II E E 314 Signals & Systems II

E E 333 AC Circuit Analysis & Intro to Power Sys. E E 391 Intro to Electric Power Engineering

E E 340 Fields and Waves E E 351 App. Electromagnetics

E E 402 Capstone Design I E E 418 Capstone Design I

E E 404 Capstone Design II E E 419 Capstone Design II

**2019-2020 BSEE Roadmap (Sample Degree Plan)**

(121 – 123 Credits)

|  |
| --- |
| FRESHMAN-FIRST YEAR  |
| FALL SEMESTER |  | SPRING SEMESTER |
| Course # | CR |  | Course # | CR |
| EE 100 Intro Electrical & Comp. Engin. | 4 |  | CHEM 111 General Chemistry I | 4 |
| ENG 100 Freshman Experience | 3 |  | EE 112 Embedded Systems | 4 |
| ENGL 111G Rhetoric & Composition | 4 |  | MATH 192 Calculus II | 4 |
| MATH 191 Calculus I | 4 |  | *General Edu Req (I,IV,V, VI or VWW)* | 3 |
|  | 15 |  |  | 15 |

|  |
| --- |
| SOPHOMORE-SECOND YEAR  |
| FALL SEMESTER |  | SPRING SEMESTER |
| Course # | CR |  | Course # | CR |
| EE 212 Intro Comp Arch & Org | 4 |  | MATH 392 Differential Equations | 3 |
| EE 200 Linear Alg, Prob & Stat Apps | 4 |  | EE 230 Circuits & Intro Electronics | 4 |
| PHYS 215 + 215L Physics I | 4 |  | EE 240 Multivariate & Vector Calc Apps | 3 |
| *General Edu Req (I,IV,V, VI or VWW)* | 3 |  | PHYS 216 + 216L Physics II | 4 |
|  |  |  | *General Edu Req (I,IV,V, VI or VWW)* | 3 |
|  | 15 |  |  | 17 |

|  |
| --- |
| JUNIOR-THIRD YEAR  |
| FALL SEMESTER |  | SPRING SEMESTER |
| Course # | CR |  | Course # | CR |
| EE 300 Cornerstone Design | 2 |  | EE 317 Semicond. & Electronics | 4 |
| EE 320 Signals & Systems I | 3 |  | EE 325 Signals & Systems II | 4 |
| EE 340 Fields & Waves | 4 |  | EE Concentration Required | 3 |
| EE 333 AC Circuits & Intro Power Sys. | 3 |  | *General Edu Req (I,IV,V or VWW)* | 3 |
| *General Edu Req (I,IV,V or VWW)* | 3 |  |  |  |
|  | 15 |  |  | 14 |

|  |
| --- |
| SENIOR-FOURTH YEAR  |
| FALL SEMESTER |  | SPRING SEMESTER |
| Course # | CR |  | Course # | CR |
| EE 402 or ENGR 401 Capstone Design I | 3 |  | EE 404 or ENGR 402 Capstone Des. II | 3 |
| EE Concentration Required | 3 |  | EE Concentration Elective  | 3 |
| EE Concentration Elective (or 4 CR) | 3 |  | STEM Elective | 3 |
| STEM Elective | 3 |  | OO Programming Elective (or 4 CR) | 3 |
| *General Edu Req (I,IV,V, VI or VWW)* | 3 |  | *General Edu Req (I,IV,V, VI or VWW)* | 3 |
| (or 16 CR) | 15 |  | (or 16 CR) | 15 |

**2019-2020 BSEE Roadmap (Sample Degree Plan) (121 – 123 Credits)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Freshman** | **Sophomore** | **Junior** | **Senior** |
| 15 credits | 15 credits | 15 credits | 17 credits | 15 credits | 14 credits | 15-16 credits | 15-16 credits |
| 4MATH 191Calculus IMATH 190 orMATH PLCMNT | 4MATH 192Calculus IIMATH 191 | 4E E 200Linear Algebra, Prob. & StatE E 112 & MATH 192 | 3E E 240Multivariate & Vector Calc.E E 112 & MATH 192 | 4E E 340Fields and WavesE E 230, E E 240 & MATH 192 | 4E E 317Semiconductors & ElectronicsCHEM 111 & E E 230 | 3E E 402 or ENGR 401Capstone Des. IE E 300, 317, 325& E E 333, 340 | 3E E 404 or ENGR 402Capstone Des. IIE E 300, 317, 325E E 333, 340, 402 |
| 3ENGR 100Intro to Engineering*(MATH 121)* | 4CHEM 111GeneralChemistry IMATH 120 | 4PHYS 215+215LEngineering Physics IMATH 191  | 4PHYS 216+216LEngineering Physics IIMATH 192 & PHYS 215 | 3E E 320 Signals and Systems IE E 200 & E E 230*(MATH 392)* | 4E E 325 Signals and Systems IIE E 320 & MATH 392 | 3E E Concentration Required2 of 2 | 3-4Object-Oriented Programming Elective |
| 4E E 100Intro Elect. Engineering*(MATH 190)*  | 4E E 112Embedded Systems*(E E 100)* | 4E E 212Computer OrganizationE E 100 &MATH 190*(E E 112)* | 4E E 230Circuits & Intro ElectronicsEE 100,MATH 192*(PHYS 216)* | 3E E 333AC Circuits & Intro Power Sys.E E 230 | 3E E Concentration Required1 of 2 | 3-4E E Concentration Elective1 of 2 | 3E E Concentration Elective2 of 2 |
| 4ENGL 111Rhetoric & CompositionENGLISH PLCMNT | 3COMM 265Princ. Human Communication | 3ENGL 218Technical & Sci. CommunicationENGL 111 | 3MATH 392Differential EquationsMATH 192 | 2E E 300Cornerstone DesignE E 212 & E E 230 | 3General Education Area IV, V, or VI3 of 3 | 3STEM Elective1 of 2 | 3STEM Elective1 of 2 |
| LEGENDPre-requisite example – E E 100Co-requisite example – *(MATH 190)* | 3General Education Area IV, V, or VI1 of 3 | 3General Education Area IV, V, or VI2 of 3 |  | 3Gen. Ed. Viewing a Wider World1 of 2 | 3Gen. Ed. Viewing a Wider World2 of 2 |

**ECE Core Curriculum Flowchart (2019-2020)**

