



**ENGINEERING SCIENCE
AND MECHANICS**

Foundational and Technical Electives for the Engineering Science Major

Foundational Electives

The intent of the foundational electives (FE) courses is to provide flexibility in the third-year courses, while maintaining a high level of technical content (i.e., not introductory/overview courses), providing breadth of topics covered (i.e., not to become a third-year area of concentration), and supporting potential deeper study in the fourth year of studies.

A total of five FE courses are required for graduation. Some courses on the lists shown below are suitable as Technical Electives, but each course can only be used to fulfill one degree requirements, either a foundational elective or technical elective.

Students must complete courses selected from the following lists for a total of 15 to 17 credits. No more than one 100-level course may be selected.

Core Courses (select 3–5 courses):

- CHEM 112: Chemical Principles II
- AERSP 308H: Mechanics of Fluids
- E MCH 416H: Failure and Analysis of Solids
- E SC 400H: Electromagnetic Fields
- E SC 419: Electronic Properties and Applications of Materials

Core Course Substitutions:

- For AERSP 308H: AERSP 311, BME 409, CH E 330H, C E 360, EME 303, or M E 320
- For E SC 419: E SC 314
- For E SC 400H: E E 330 or PHYS 400

Alternative Courses (select 0–2 courses):

- AERSP 301, 304, 309, 312
- A E 311
- B E 300, 302, 304, 306

- B M B 251
- BME 201, 301, 303
- BIOL 110, 141, 230M, 240M
- C E 335, 340, 370
- CH E 210H, 320H
- CHEM 210
- CMPEN 270, 331
- CMPSC 122, 221, 311, 312, 360
- E E 310, 320, 340, 350
- E SC 313, 3xx, 4xx
- EGEE 302, 304
- ENGR 320
- I E 305, 311, 312, 322H, 323, 327, 330
- M E 360, 367, 370, 380
- MATH 311M, 315
- MATSE 400, 402, 443
- METEO 308
- NUCE 300, 301, 309

Download a [printable version](#) of the Foundational Electives

For more details on foundational electives, please refer to the [Undergraduate Program Guide](#).

Technical Electives

The purpose of the technical elective (TE) courses is to enable students to pursue broader studies in selected subjects related to their chosen field. These courses are selected by each student from the list shown below, but other courses may be permitted by petition.

A total of four TE courses are required. At least two of the four technical electives must be from the Engineering Courses list.

Engineering Courses (select 2–4 courses):

Courses in **boldface type** can be used as either a Technical Elective or a Foundational Elective.

- AERSP 412, 424, 440, 460, 473, 490, 492
- A E 421, 424, 430, 456, 461, 464, 467, 470
- BME 402, 406, **409**, 410, 413, 419, 423, 443, 444, 445
- B E 461, 465, 467, 468, 477, 487
- CH E 350, 432, 438, 442
- C E 447, 461, 462, 475, 479
- CMPEN 416, 417, 431, 441, 454, 455, 461, 471, 472, 475

- CMPSC 402, 421, 426, 428, 430, 431W, 436, 438, 441, 442, 448, 450, 456, 457, 458, 459, 461, 462, 463, 464, 465, 467, 469, 471, 473, 474, 479
- E E 413, 416, 417, 420, 422, 424, 430, 432, 438, 439, 441, 442, 450, 453, 454, 455, 456, 458, 460, 461, 471, 472, 474, 477, 481, 483, 484
- EGEE 411, 412, 420, 430, 433, 436, 437, 438, 441, 451, 455, 456, 470
- EME 407
- ENGR 421, 450
- EDSGN 401, 452, 479
- E MCH 400, 402, 403, 409, **416H**, 440, 446, 461, 470, 471, 473
- E SC **400H**, 417, **419**, 445, 450, 455, 456, 475, 481, 482, 483, 484
- ENVE 417, 424, 470
- ENVSE 404W, 440, 470
- I E 405, 408, 418, 419, 424, 425, 428, 433, 434, 436, 454, 455, 456, 460, 462, 463, 464, 466, 467, 468, 470, 477, 478, 479
- MATSE **400**, **402**, 403, 404, 409, 410, 411, 412, 413, 417, 421, 422, 426, 430, 435, 436, 440, 441, 443, 444, 445, 446, 447, 448, 450, 455, 475, 483
- M E 400, 401, 402, 403, 404, 405, 406, 408, 410, 411, 420, 421, 422, 427, 428, 430, 431, 432, 433, 444, 446, 448, 456, 460, 461, 462, 468, 470, 471, 480, 481
- NUC E 401, 405, 406, 408, 409, 420, 428, 430, 446, 450, 451
- PNG 450, 475, 480

Other Courses (select 0–2 courses):

- CHEM 212, 402, 406, 452, 466, 472
- F SC 431
- MATH 419, 450, 461
- METEO 421, 436, 477
- PHYS 406, 410, 411, 412, 414, 419, 421W, 443, 457W, 458, 461, 462, 472

Only one of the following may be used to fulfill a technical elective requirement:

- ENGR 295+395+495 – student must complete all three co-op rotations
- 3 credits of coursework required for a minor – student must complete the minor
- EDSGN 4xx (Solid Works/Advanced CAD)

Exceptions for technical electives not included on this list will be considered by department petition.

Please note: Some of these courses may be enrollment-controlled for students in the major. In these cases, please check with the specific department to determine its policy on letting students from other majors enroll in its courses.

Download a [printable version](#) of the Technical Electives.

For more details on technical electives, please refer to the [Undergraduate Program Guide](#).



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The Penn State Department of Engineering Science and Mechanics (ESM) is an internationally distinguished department that is recognized for its globally competitive excellence in engineering and scientific accomplishments, research, and educational leadership.

Our Engineering Science program is the official undergraduate honors program of the College of Engineering, attracting the University's brightest engineering students. We also offer graduate degrees in ESM, engineering mechanics, engineering at the nano-scale, and an integrated undergraduate/graduate program.

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