

Engineering Science

Faculty: Hernandez, Grega, Program Coordinators

Engineering science is an interdisciplinary program leading to a Bachelor of Science in Engineering Science with a specialization in Engineering Management or Policy and Society. The Engineering Science program is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

Program Educational Objectives

The engineering science program has established the following educational objectives. These objectives outline what TCNJ engineers should be able to accomplish during the first few years after graduation.

- To contribute to the economic development of New Jersey and the nation through the ethical practice of engineering;
- To become successful in their chosen career path, whether it is in the practice of engineering, in advanced studies in engineering or science, or in other complementary disciplines;
- To assume leadership roles in industry or public service through engineering ability, communication skills, teamwork, understanding of contemporary global and socio-economic issues, and use of modern engineering tools;
- To maintain career skills through life-long learning and be on the way towards achieving professional licensure.

Engineering Science/Engineering Management Specialization

The engineering management specialization integrates engineering and management education to prepare students for engineering management. This program provides a strong base in a specific field of engineering while also allowing the flexibility to take business courses covering a diverse range of topics such as finance, management, and marketing. A graduate of this program would be capable of acquiring a position that is highly technical in nature, or one that is more business oriented. With a broad set of skills in place, bridging the gap between technology and business becomes a natural transition. Engineering management students must select a mechanical, electrical, or computer option for their studies.

Engineering Science/Policy and Society Specialization

Graduates who specialize in Policy and Society are students that want to pursue an accredited and licensable engineering degree program, but intend to work and lead in para-technical fields in government agencies; such as FBI, NSA, CIA, NIH, DOE, DOD, and other general agencies. The program also serves students that want to pursue an engineering degree prior to entering law school. Engineering for Policy and Society examines the development of structures, devices, technologies, and methods that address problems relevant to how engineering may be used to improve the lives of people and society at large. Solutions that should contribute to both the protection and promotion of 1) safety and human welfare, 2) equality and social justice, 3) economic development and progress, as well as 4) environmental preservation and sustainability.

Engineering Science Student Outcomes

The program outcomes listed below are expected of all graduates of the engineering science program. These outcomes outline what TCNJ engineering science graduates are expected to know and be able to do at graduation. These outcomes outline the knowledge, abilities, tools, and skills the program gives the graduates to enable them to accomplish the program educational objectives.

Engineering science/engineering management specialization graduates will have:

- An ability to apply knowledge of mathematics, science, and engineering;
- An ability to design and conduct experiments, as well as to analyze and interpret data;
- An ability to design a system, component, or process to meet desired needs;
- An ability to function in multidisciplinary teams;
- An ability to identify, formulate, and solve engineering problems;
- An understanding of professional and ethical responsibility;
- An ability to communicate effectively;
- The broad education necessary to understand the impact of engineering solutions in a global and societal context;
- A recognition of the need for and an ability to engage in life-long learning;
- A knowledge of contemporary issues; and
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Academic Policies and Standards

A student may repeat any course without seeking approval. However, if a student wishes to repeat a course more than once, permission must be obtained from the chair of the department or coordinator of the program of study and, if appropriate, the chair of the department offering the course. Permission to repeat a major course more than once will be granted only in cases of extreme extenuating circumstances, e.g., illness, financial, etc. When an engineering course is repeated, only the most recent earned grade is counted in the grade point average, although all grades earned will appear on the student's transcript.

Seniors pursuing bachelor of science degrees in an engineering major are required to take the Fundamentals of Engineering Examination for the Professional Engineer's License.

Given the nature of the engineering curricula, it is extremely important to follow the recommended course sequence. Violations of this guideline may result in dismissal from the engineering majors.

Program Entrance, Retention, and Exit Standards

Every major program at the College has set standards for allowing students to remain in that program, to transfer within the College from one program to another, and to graduate from a program. The following are the standards for engineering majors. Minimum grades are noted in parentheses.

- Retention in the engineering programs is based on the following performance standards in these “critical content courses”: PHY 201 (C–); MAT 127 (C–), MAT 128 (C–). A student who does not achieve these minimum performance standards, earns a grade of F, and/or has a cumulative GPA of less than 2.0 will be placed on the Engineering Programs Retention List. Placement on the Retention List for two consecutive semesters or three non-consecutive semesters will result in dismissal from the major. Students dismissed from the major may appeal for re-entry into the major.
- To ensure academic success, first year, sophomore, and first-semester junior students will not be permitted to take more than 4.5 course units unless they have a GPA of 2.75 or greater. Upper class students can register for 5.5 course units if they are in good academic standing.
- Entrance (internal transfer) into the engineering programs from another program within the College is based upon the following performance standards in these “foundation courses”: PHY 201 (C–); MAT 127(C–), MAT 128 (C–). Internal transfer within engineering programs will be considered as long as enrollment limits are not exceeded.
- Graduation requires an in-major cumulative GPA of 2.0.

Bachelor of Science in Engineering Science—Engineering Management Specialization, Computer Preference

First Year

Fall

| | | |
|-----|--|---------------|
| CHE | 201/General Chemistry I | 1 course unit |
| ENG | 142/Fundamentals of Engineering Design | |
| | <i>or</i> | |
| CSC | 215/Computer Science I | 1 course unit |
| ENG | 095/Introduction to Engineering | 0 course unit |
| ENG | 091/Engineering Seminar I | 0 course unit |
| FSP | First Seminar | 1 course unit |
| MAT | 127/Calculus A | 1 course unit |
| PHY | 201/General Physics I | 1 course unit |

Spring

| | | |
|-----|--|-----------------|
| CSC | 215/Computer Science I | |
| | <i>or</i> | |
| ENG | 142/Fundamentals of Engineering Design | 1 course unit |
| ENG | 092/Engineering Seminar II | 0 course unit |
| MAT | 128/Calculus B | 1 course unit |
| PHY | 202/General Physics II | 1 course unit |
| WRI | 102/Academic Writing (if not exempted) | (1 course unit) |
| TST | 161/Creative Design | 1 course unit |

Sophomore Year

Fall

| | | |
|-----|--|----------------|
| CSC | 250/Accelerated Computer Science I, II | 1 course unit |
| ECO | 101/Principles of Microeconomics | 1 course unit |
| ENG | 212/Circuits Analysis | 1 course unit |
| ENG | 214/Circuits Analysis Laboratory | .5 course unit |
| ENG | 232/Manufacturing Processes | 1 course unit |
| ENG | 272/Advanced Engineering Mathematics I | 1 course unit |

Spring

| | | |
|-----|--|---------------|
| ACC | 201/Financial Accounting and Reporting | 1 course unit |
| ECO | 102/Principles of Macroeconomics | 1 course unit |
| ENG | 222/Statics | 1 course unit |
| ENG | 312/Digital Circuits and Microprocessors | 1 course unit |
| MAT | 229/Multivariable Calculus | 1 course unit |

Junior Year**Fall**

| | | |
|-----|--|----------------|
| BUS | 200/Legal and Regulatory Environment of Business | 1 course unit |
| ELC | 451/Computer Architecture and Organization | 1 course unit |
| ELC | 363/Computer Engineering Laboratory I | .5 course unit |
| ENG | 093/Engineering Seminar III | 0 course unit |
| MEC | 321/Numerical Analysis | 1 course unit |
| MKT | 201/Marketing Principles | .5 course unit |
| MGT | 201/Managing in the 21 st Century | .5 course unit |
| ENG | 372/Engineering Economy | 1 course unit |

Spring

| | | |
|-----|--|----------------|
| ENG | 094/Engineering Seminar IV | 0 course unit |
| ENG | 152/Engineering Material Science | 1 course unit |
| ENG | 262/Dynamics | 1 course unit |
| ENG | 342/Advanced Engineering Mathematics II | 1 course unit |
| ENG | 452/Project Management | 1 course unit |
| MGT | 201/Managing in the 21 st Century | .5 course unit |
| IDS | 252/Society, Ethics, and Technology | 1 course unit |

Senior Year**Fall**

| | | |
|-----|-----------------------------------|----------------|
| ELC | 495/Senior Project I | .5 course unit |
| ENG | 099/Senior Professional Seminar | 0 course unit |
| ENG | 322/Thermodynamics I | 1 course unit |
| ENG | 352/Control Systems | 1 course unit |
| ENG | 354/Control Systems Laboratory | .5 course unit |
| FIN | 201/Fundamental Financial Methods | .5 course unit |
| | Liberal Learning Elective* | 1 course unit |

Spring

| | | |
|-----|--|----------------|
| ELC | 496/Senior Project II | .5 course unit |
| ENG | 098/Fundamentals of Engineering Review | 0 course unit |
| ELC | 463/Computer Engineering Laboratory II | .5 course unit |
| | Computer Engineering Elective* | 1 course unit |
| | Management Elective* | 1 course unit |
| | Liberal Learning Elective* | 1 course unit |

Total course units**39 course units****By advisement only.*

Bachelor of Science in Engineering Science—Engineering Management Specialization, Electrical Preference

First Year

Fall

| | | |
|-----|--|---------------|
| CHE | 201/General Chemistry I | 1 course unit |
| ENG | 142/Fundamentals of Engineering Design | |
| | <i>or</i> | |
| CSC | 215/Computer Science I | 1 course unit |
| ENG | 095/Introduction to Engineering | 0 course unit |
| ENG | 091/Engineering Seminar I | 0 course unit |
| FSP | First Seminar | 1 course unit |
| MAT | 127/Calculus A | 1 course unit |
| PHY | 201/General Physics I | 1 course unit |

Spring

| | | |
|-----|--|-----------------|
| CSC | 215/Computer Science I | |
| | <i>or</i> | |
| ENG | 142/Fundamentals of Engineering Design | 1 course unit |
| ENG | 092/Engineering Seminar II | 0 course unit |
| MAT | 128/Calculus B | 1 course unit |
| PHY | 202/General Physics II | 1 course unit |
| WRI | 102/Academic Writing (if not exempted) | (1 course unit) |
| TST | 161/Creative Design | 1 course unit |

Sophomore Year

Fall

| | | |
|-----|--|----------------|
| ECO | 101/Principles of Microeconomics | 1 course unit |
| ENG | 212/Circuits Analysis | 1 course unit |
| ENG | 214/Circuits Analysis Laboratory | .5 course unit |
| ENG | 232/Manufacturing Processes | 1 course unit |
| ENG | 272/Advanced Engineering Mathematics I | 1 course unit |
| ENG | 312/Digital Circuits and Microprocessors | 1 course unit |

Spring

| | | |
|-----|---|----------------|
| ACC | 201/Financial Accounting and Reporting | 1 course unit |
| ECO | 102/Principles of Macroeconomics | 1 course unit |
| ELC | 251/Electronics | 1 course unit |
| ELC | 321/Signals and Systems | 1 course unit |
| ELC | 333/Electrical Engineering Laboratory I | .5 course unit |
| MAT | 229/Multivariable Calculus | 1 course unit |

Junior Year

Fall

| | | |
|-----|---|---------------|
| ENG | 372/Engineering Economy | 1 course unit |
| ELC | 341/Communications Systems | 1 course unit |
| ENG | 093/Engineering Seminar III | 0 course unit |
| ENG | 222/Statics | 1 course unit |
| ENG | 342/Advanced Engineering Mathematics II | 1 course unit |
| MEC | 321/Numerical Analysis | 1 course unit |

MKT 201/Marketing Principles .5 course unit

Spring

ENG 094/Engineering Seminar IV 0 course unit
 ENG 152/Engineering Material Science 1 course unit
 ENG 262/Dynamics 1 course unit
 ENG 452/Project Management 1 course unit
 MGT 201/Managing in the 21st Century .5 course unit
 BUS 200/Legal and Regulatory Environment of Business 1 course unit
 IDS 252/Society, Ethics, and Technology 1 course unit

Senior Year

Fall

ELC 495/Senior Project I .5 course unit
 ENG 099/Senior Professional Seminar 0 course unit
 ENG 352/Control Systems 1 course unit
 ENG 354/Control Systems Laboratory .5 course unit
 FIN 201/Fundamental Financial Methods .5 course unit
 Electrical Engineering Elective* 1 course unit
 Liberal Learning Elective* 1 course unit

Spring

ELC 496/Senior Project II .5 course unit
 ENG 098/Fundamentals of Engineering Review 0 course unit
 ENG 322/Thermodynamics I 1 course unit
 Management Elective* 1 course unit
 Liberal Learning Elective* 1 course unit

Total course units

39 course units

**By advisement only.*

Electrical Engineering Electives

ELC 361/Digital Signal Processing
 ELC 383/Electronics II
 ELC 411/Embedded Systems
 ELC 431/RF/Microwave Engineering
 ELC 441/Digital Systems Engineering
 ELC 453/Digital Control Systems
 ELC 473/Bioinstrumentation
 ELC 483/Robotics
 ELC 492/Independent Study
 ENG 472/Special Topics in Engineering
 ENG 412/Process & Quality Control

Bachelor of Science in Engineering Science—Engineering Management Specialization, Mechanical Preference

First Year

Fall

CHE 201/General Chemistry I 1 course unit
 ENG 142/Fundamentals of Engineering Design
or
 CSC 215/Computer Science I 1 course unit

| | | |
|-----|---------------------------------|---------------|
| ENG | 095/Introduction to Engineering | 0 course unit |
| ENG | 091/Engineering Seminar I | 0 course unit |
| FSP | First Seminar | 1 course unit |
| MAT | 127/Calculus A | 1 course unit |
| PHY | 201/General Physics I | 1 course unit |

Spring

| | | |
|-----|--|-----------------|
| CSC | 215/Computer Science I | |
| | <i>or</i> | |
| ENG | 142/Fundamentals of Engineering Design | 1 course unit |
| ENG | 092/Engineering Seminar II | 0 course unit |
| MAT | 128/Calculus B | 1 course unit |
| PHY | 202/General Physics II | 1 course unit |
| WRI | 102/Academic Writing (if not exempted) | (1 course unit) |
| TST | 161/Creative Design | 1 course unit |

Sophomore Year**Fall**

| | | |
|-----|--|----------------|
| ECO | 101/Principles of Microeconomics | 1 course unit |
| ENG | 212/Circuits Analysis | 1 course unit |
| ENG | 214/Circuits Analysis Laboratory | .5 course unit |
| ENG | 222/Statics | 1 course unit |
| ENG | 232/Manufacturing Processes | 1 course unit |
| ENG | 272/Advanced Engineering Mathematics I | 1 course unit |

Spring

| | | |
|-----|----------------------------------|----------------|
| ECO | 102/Principles of Macroeconomics | 1 course unit |
| ENG | 152/Engineering Material Science | 1 course unit |
| ENG | 262/Dynamics | 1 course unit |
| MAT | 229/Multivariable Calucus | 1 course unit |
| MEC | 251/Strength of Materials | 1 course unit |
| MEC | 263/Strength of Materials | .5 course unit |

Junior Year**Fall**

| | | |
|-----|---|---------------|
| ENG | 093/Engineering Seminar III | 0 course unit |
| ENG | 322/Thermodynamics I | 1 course unit |
| ENG | 342/Advanced Engineering Mathematics II | 1 course unit |
| ENG | 372/Engineering Economy | 1 course unit |
| MEC | 311/Mechanical Design Analysis I | 1 course unit |
| MEC | 321/Numerial Analysis | 1 course unit |

Spring

| | | |
|-----|--|----------------|
| ENG | 094/Engineering Seminar IV | 0 course unit |
| ENG | 452/Project Management | 1 course unit |
| MEC | 361/Fluid Mechanics | 1 course unit |
| ACC | 201/Financial Accounting | 1 course unit |
| MGT | 201/Managing in the 21 st Century | .5 course unit |

Liberal Learning Elective* 1 course unit

* By advisement only.

Senior Year**Fall**

| | | |
|-----|--|----------------|
| ENG | 099/Senior Professional Seminar | 0 course unit |
| ENG | 352/Control Systems | 1 course unit |
| ENG | 354/Control Systems Laboratory | .5 course unit |
| FIN | 201/Fundamental Financial Methods | .5 course unit |
| MKT | 201/Marketing Principles | .5 course unit |
| IDS | 252/Society Ethics & Technology | 1 course unit |
| MEC | 495/Senior Project I | 0 course unit |
| | Mechanical Engineering or Management Elective* | 1 course unit |

Spring

| | | |
|-----|--|---------------|
| ENG | 098/Fundamentals of Engineering Review | 0 course unit |
| ENG | 312/Digital Circuits and Microprocessors | 1 course unit |
| BUS | 200/Legal Regulatory Environment | 1 course unit |
| MEC | 496/Senior Project II | 1 course unit |
| | Mechanical Engineering or Management Elective* | 1 course unit |
| | Liberal Learning Elective* | 1 course unit |

Total course units**39 course units*** *By advisement only.***Mechanical Engineering Electives**

MEC 343/Biomechanics
 MEC 371/Thermodynamics II
 MEC 411/Heat Transfer
 MEC 421/Kinematics and Mechanisms
 MEC 423/Intro to Biomaterials
 MEC 431/Mechanical Design Analysis II
 MEC 441/Vibration Analysis
 MEC 453/Digital Control Systems
 MEC 471/Compressible Fluid Mechanics
 MEC 473/Bioinstrumentation
 MEC 481/Advanced Strength of Materials
 MEC 483/Robotics
 MEC 492/Independent Study
 ENG 470/Special Topics in Engineering
 ENG 412/Process and Quality Control

Bachelor of Science in Engineering Science—Policy and Society Specialization**First Year****Fall**

| | | |
|-----|--|---------------|
| CHE | 201/General Chemistry I | 1 course unit |
| ENG | 142/Fundamentals of Engineering Design | |
| | <i>or</i> | |
| CSC | 215/Computer Science I | 1 course unit |
| ENG | 095/Introduction to Engineering | 0 course unit |
| ENG | 091/Engineering Seminar I | 0 course unit |
| FSP | First Seminar (Social Sciences)* | 1 course unit |
| MAT | 127/Calculus A | 1 course unit |
| PHY | 201/General Physics I | 1 course unit |

Spring

| | | |
|-----|--|-----------------|
| CSC | 215/Computer Science I | |
| | <i>or</i> | |
| ENG | 142/Fundamentals of Engineering Design | 1 course unit |
| ENG | 092/Engineering Seminar II | 0 course unit |
| MAT | 128/Calculus B | 1 course unit |
| PHY | 202/General Physics II | 1 course unit |
| WRI | 102/Academic Writing (if not exempted) | (1 course unit) |
| TST | 161/Creative Design | 1 course unit |

**By advisement only.*

Sophomore Year**Fall**

| | | |
|-----|--|----------------|
| ECO | 101/Principles of Microeconomics | 1 course unit |
| ENG | 212/Circuits Analysis | 1 course unit |
| ENG | 214/Circuits Analysis Laboratory | .5 course unit |
| ENG | 222/Statics | 1 course unit |
| ENG | 232/Manufacturing Processes | 1 course unit |
| ENG | 272/Advanced Engineering Mathematics I | 1 course unit |

Spring

| | | |
|-----|--|---------------|
| ENG | 152/Engineering Material Science | 1 course unit |
| ENG | 262/Dynamics | 1 course unit |
| ENG | 312/Digital Circuits and Microprocessors | 1 course unit |
| MAT | 229/Multivariable Calculus | 1 course unit |
| | Policy and Society Elective* | 1 course unit |

Junior Year**Fall**

| | | |
|-----|---|---------------|
| ENG | 093/Engineering Seminar III | 0 course unit |
| ENG | 342/Advanced Engineering Mathematics II | 1 course unit |
| MEC | 321/Numerical Analysis | 1 course unit |
| ENG | 372/Engineering Economy | 1 course unit |
| | Engineering Elective* | 1 course unit |
| | Policy and Society Elective* | 1 course unit |

Spring

| | | |
|-----|-------------------------------------|---------------|
| ENG | 094/Engineering Seminar IV | 0 course unit |
| ENG | 452/Project Management | 1 course unit |
| IDS | 252/Society, Ethics, and Technology | 1 course unit |
| | Engineering Electives* | 2 course unit |
| | Liberal Learning Elective* | 1 course unit |

**By advisement only.*

Summer

| | | |
|-----|--|---------------|
| POL | 399/Internship in Public Affairs | 1 course unit |
| | OR | |
| POL | 401/TCNJ Washington Internship | 1 course unit |
| POL | 402/TCNJ Washington Coursework | 1 course unit |
| POL | 403/TCNJ Washington Leadership Seminar | 1 course unit |

Students pursuing this option must take at least one Political Science course as part of their Policy and Society electives before their senior year.

Senior Year**Fall**

| | |
|-------------------------------------|----------------|
| ELC 495/Senior Project I | .5 course unit |
| ENG 099/Senior Professional Seminar | 0 course unit |
| ENG 322/Thermodynamics I | 1 course unit |
| Policy and Society Electives* | 2 course unit |

Spring

| | |
|--|-----------------|
| ELC 496/Senior Project II | .5 course unit |
| ENG 098/Fundamentals of Engineering Review | 0 course unit |
| ENG 352/Control Systems | 1 course unit |
| ENG 354/Control Systems Laboratory | .5 course unit |
| Policy and Society Elective* | 2/0 course unit |
| Liberal Learning Elective* | 1 course unit |

Total course units**39 course units****By advisement only.***Engineering Electives****3 CU - At least 2 CU must be of the same course prefix (ELC or MEC).**

| | |
|---------------------------------------|-------|
| ENG 348/Systems Engineering | (0.5) |
| ELC 251/Electronics | (1) |
| ELC 333/Electronics Laboratory | (0.5) |
| ELC 321/Systems & Signals | (1) |
| ELC 341/Communication Systems | (1) |
| ELC 343/Microcomputer Systems | (0.5) |
| ELC 423/Digital Signal Processing | (1) |
| MEC 251/Strength of Materials | (1) |
| MEC 263/Mechanical Engineering Lab. I | (0.5) |
| MEC 311/Mechanical Design Analysis I | (1) |
| MEC 361/Fluid Mechanics | (1) |
| MEC 421/Kinematics | (1) |

Policy and Society Electives**4 or 6 CU - At least 2 CU must be at the 300 level or above.**

| | |
|--|-----|
| PHL 275/Philosophy of Law | (1) |
| BUS 200/Legal and Regulatory Environment of Business | (1) |
| BUS 300/Law for Business | (1) |
| BUS 360/International Business Law | (1) |
| ECO 102/Principles of Macroeconomics | (1) |
| ECO 345/Comparative Economic Systems | (1) |
| POL 320/Constitutional Law | (1) |
| POL 321/Civil Liberties | (1) |
| POL 380/International Political Economy | (1) |
| POL 355/Political Economy of Natural Resources | (1) |
| POL 305/American Public Policy | (1) |
| POL 200/Political Analysis | (1) |
| SOC 345/Inequality, Pollution and the Environment | (1) |
| HIS 176/American Technology | (1) |
| POL 230/International Relations | (1) |
| POL 250/Politics and Society in Developing Countries | (1) |
| POL 316/Public Opinion, Voting and Elections | (1) |
| PHL 240/Political Philosophy | (1) |

| | |
|--|-----|
| SOC 355/Introduction to Urban Planning | (1) |
| SOC 336/Cultural and Social Change | (1) |
| ANT 341/Environmental Anthropology | (1) |
| ANT 340/Social Change in Latin America | (1) |

Minor in Engineering Science

Option A—Mechanical Engineering

| | |
|--------------------------|---------------|
| ELE 251/Electronics | 1 course unit |
| ENG 212/Circuit Analysis | 1 course unit |
| ENG 222/Statics | 1 course unit |
| ENG 262/Dynamics | 1 course unit |
| Engineering Elective* | 1 course unit |

Total course units

5 course units**

* *By advisement.*

** *Only one course unit taken as part of the student's major may also be counted toward the student's minor.*

Minor in Engineering Science

Option B—Civil Engineering

| | |
|---------------------------------|---------------|
| CIV 251/Strength of Materials | 1 course unit |
| CIV 311/Structural Analysis | 1 course unit |
| CIV 351/Structural Steel Design | 1 course unit |
| ENG 222/Statics | 1 course unit |
| Engineering Elective* | 1 course unit |

Total course units

5 course units**

* *By advisement.*

** *Only one course unit taken as part of the student's major may also be counted toward the student's minor.*