

## Engineering Science

*Faculty: Adegbege, Program Coordinator*

Engineering Science is an interdisciplinary program leading to a Bachelor of Science in Engineering Science with a specialization in Engineering Management or Robotics. The Bachelor of Science in Engineering Science is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org>, under the commission's General Criteria and Program Criteria for Engineering, General Engineering, Engineering Physics, and Engineering Science.

### 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 technical, societal, and/or economic development of New Jersey and the nation through the ethical practice of engineering and related fields;
- 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;
- To maintain career skills through life-long learning.

### 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 Science/Robotics Specialization

The Robotics specialization provides engineering science students an opportunity to explore robotics concepts and apply to designs. The specialization offers a strong engineering foundation with coursework in automation, control systems and robotic design. This program equips graduates to innovate in industries such as manufacturing, health care, and autonomous systems.

### **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 graduates will have:

- (1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- (2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- (3) An ability to communicate effectively with a range of audiences.
- (4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- (5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- (6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- (7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

### **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.

Given the nature of the engineering curricula, it is extremely important to follow the recommended course sequence. Violations of this guideline may delay time to graduation.

### **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.
- 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). Students must also be in good academic standing. Students who have not completed these foundation courses will be admitted as a Pre-Major and must complete them by the following semester. 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**

#### **First Year**

##### **Fall**

CHE	201/General Chemistry I	1 course unit
ENG	144/Fundamentals of Engineering Design	0.5 course unit
ENG	095/Introduction to Engineering	0 course unit
MAT	127/Calculus A	1 course unit
PHY	201/General Physics I	1 course unit
FYS	16x/First-Year Seminar	1 course unit

##### **Spring**

CSC	217/Computer Science I: Python	1 course unit
<i>or</i>		
CSC	220/Computer Science I: Computer Problem Solving	
ENG	145/Introduction to Engineering Science and Design	0.5 course unit
MAT	128/Calculus B	1 course unit
PHY	202/General Physics II	1 course unit
Core	College Core Elective*	1 course unit

#### **Sophomore Year**

##### **Fall**

ENG	152/Engineering Material Science	1 course unit
ENG	212/Circuits Analysis	1 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	214/Circuits Analysis Laboratory	.5 course unit
ENG	262/Dynamics	1 course unit

ECO	101/Principles of Microeconomics	1 course unit
<i>or</i>		
ECO	102/Principles of Macroeconomics	
MEC	251/Strength of Materials	1 course unit
MAT	229/Multivariable Calculus	1 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
TechE	Engineering Elective	1 course unit
MKT	201/Marketing Principles	.5 course unit
MGT	201/Managing in the 21 <sup>st</sup> Century	.5 course unit

**Spring**

ENG	094/Engineering Seminar IV	0 course unit
ENG	348/Systems Engineering and Economy	1 course unit
ENG	352/Control Systems	1 course unit
TechE	Engineering Elective	1 course unit
TechE	Engineering Elective	1 course unit
FIN201	Fundamental Financial Methods	.5 course unit

**Senior Year****Fall**

ENG	099/Senior Professional Seminar	0 course unit
ENG	354/Control Systems Laboratory	.5 course unit
ELC/MEC495	Senior Project I	.5 course unit
Core	College Core Elective*	1 course unit
ACC	201/Financial Accounting and Reporting	1 course unit
IDS252	Society, Ethics, and Technology	1 course unit

**Spring**

ENG	452/Project Management	1 course unit
ELC/MEC496	Senior Project II	.5 course unit
BUS	200/Legal and Regulatory Environment of Business	1 course unit
Core	College Core Elective*	1 course unit
Core	College Core Elective*	1 course unit

**Total course units****35.5 course units**Engineering Technical Electives

MEC	311/Mechanical Design Analysis I	1 course unit
<i>or</i>		
ENG	312/Digital Circuits & Microprocessor	

ELC	251/Electronics	1 course unit
<i>or</i>		
MEC	361/Fluid Mechanics	
MEC	371/Thermodynamics II	1 course unit
<i>or</i>		
Any	Engineering Technical Electives	

Engineering Technical Electives-Other

ELC	321/Signals and Systems	1 course unit
ELC	361/Engineering Electromagnetics	1 course unit
ELC	451/Computer Architecture	1 course unit
ELC/MEC483	Robotics	1 course unit
ELC	343/Biomechanics	1 course unit
MEC	421/Kinematics and Mechanism	1 course unit
ELC/MEC391	Independent Study	1 course unit
ELC/MEC470	Special Topics*	1 course unit

*\*By advisement only.*

**Bachelor of Science in Engineering Science—Robotics Specialization****First Year****Fall**

CHE	201/General Chemistry I	1 course unit
ENG	144/Fundamentals of Engineering Design	0.5 course unit
ENG	095/Introduction to Engineering	0 course unit
MAT	127/Calculus A	1 course unit
PHY	201/General Physics I	1 course unit
FYS	16x/First-Year Seminar	1 course unit

**Spring**

CSC	220/Computer Science I: Computer Problem Solving	1 course unit
ENG	145/Introduction to Engineering Science and Design	0.5 course unit
MAT	128/Calculus B	1 course unit
PHY	202/General Physics II	1 course unit
Core	College Core Elective*	1 course unit

**Sophomore Year****Fall**

CSC	230/Computer Science II	1 course unit
ENG	212/Circuits Analysis	1 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	214/Circuits Analysis Laboratory	.5 course unit
ENG	262/Dynamics	1 course unit
CSC	270/Discrete Structure	1 course unit
MEC	251/Strength of Materials	1 course unit
MAT	229/Multivariable Calculus	1 course unit

**Junior Year****Fall**

ENG	093/Engineering Seminar III	0 course unit
MEC	311/Mechanical Design Analysis I	1 course unit
ENG	312/Digital Circuits and Microprocessors	1 course unit
ENG	342/Advanced Engineering Mathematics II	1 course unit
ECO	101/Principles of Microeconomics	1 course unit
<i>or</i>		
ECO	102/Principles of Macroeconomics	

**Spring**

ENG	094/Engineering Seminar IV	0 course unit
ELC	251/Electronics	1 course unit
ELC	321/Signals and Systems	1 course unit
ENG	348/Systems Engineering and Economy	1 course unit
ENG	352/Control Systems	1 course unit
MEC	381/Introduction to Mechatronics	1 course unit

**Senior Year****Fall**

ENG	099/Senior Professional Seminar	0 course unit
ENG	354/Control Systems Laboratory	.5 course unit
ELC/MEC495	/Senior Project I	.5 course unit
MEC	483/Robotics	1 course unit
Core	College Core Elective*	1 course unit
TechE	Engineering Elective-Intelligent Systems	1 course unit

**Spring**

TechE	Engineering Elective-Engineering	1 course unit
ELC/MEC496	/Senior Project II	.5 course unit
IDS252	/Society, Ethics, and Technology	1 course unit
Core	College Core Elective*	1 course unit
Core	College Core Elective*	1 course unit

**Total course units****36 course units**

Engineering Technical Electives -Electrical

ELC 341/Communication Systems	1 course unit
ELC 383/Electronics II	1 course unit
ELC 411/Embedded Systems	1 course unit
ELC 423/Digital Signal Processing	1 course unit
ELC 480/Digital Video Compression	1 course unit

Engineering Technical Electives-Computer

ELC 451/Computer Architecture	1 course unit
ELC 470/Special Topics*	1 course unit
ELC 411/Embedded Systems	1 course unit
ELC 423/Digital Signal Processing	1 course unit
ELC 480/Digital Video Compression	1 course unit

Engineering Technical Elective-Mechanical

MEC 421/Kinematics and Mechanisms	1 course unit
MEC 431/Mechanical Design Analysis II	1 course unit
MEC 460/Finite Elements in Mechanical Design	1 course unit
MEC 470/Special Topics in Engineering*	1 course unit

Engineering Technical-Intelligent Systems

CSC 355/Human Computer Interaction	1 course unit
CSC 380/Artificial Intelligence	1 course unit
CSC 426/Machine Learning	1 course unit
ELC 435/Artificial Neural Networks	1 course unit

*\*By advisement only.*