

Technological Studies

Faculty: Cathell (Chair), Faber, Figueroa, O'Brien

We live in a highly technological age and the impacts of technology and engineering on the individual, society, and environment are great. Design, a fundamental aspect of technology & engineering, is also central to our department's teacher preparation methods. The K-12 educational system, as well as society in general, can benefit from professionals who understand the impacts and value of developing the habits of mind of designers. Our department coordinates two undergraduate teacher preparation programs: (i) Technology/pre-Engineering Education (Secondary) and (ii) Integrative-STEM Education (Elementary). [STEM: Science, Technology, Engineering and Math].

Both undergraduate teacher preparation programs are integrative STEM-based programs, studying a variety of STEM content areas and Problem-based Learning (PBL) educational methods. STEM content areas include the science and math behind design processes (for K-12 environment), historical and contemporary influence of designed objects, creativity, product development, human factors engineering, product modeling, problem-solving techniques, environmental and biotechnical systems, communications, electronics and computers, structures, mechanisms and robotics. Emphasis is placed on understanding and applying core STEM principles and applying design-based PBL pedagogies. Courses are conducted in modern classroom/laboratories housed in the School of Engineering.

Many reports have explicitly outlined the value that technology and engineering (design-based fields) have on the educational quality in the K-12 system. These include, (i) *Rise Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future* (NAS and NAE, 2007), (ii) *Rise above the Gathering Storm, revisited: Rapidly approaching Category 5* (NAE and NRC, 2010), (iii) *Engineering in K-12 Education: Understanding the Status and Improving the Prospects* (NAE and NRC, 2009), (iv) *STEM Integration in K-12 Education, Status, Prospects, and an Agenda for Research* (NAE and NRC, 2014), and (v) the Next Generation Science Standards (NGSS), which require engineering content in science courses.

New Jersey also recognizes the importance of technology and engineering through the establishment of standards for K-12 students (NJ Core Content Standard 8.2 for "Technology Education, Engineering, Design, and Computational Thinking-Programming"). Graduates of our programs receive provisional certification to teach in New Jersey schools, and most states recognize teacher candidates from NCATE/CAEP nationally accredited programs, such as TCNJ. Graduates from both the Technology/Pre-Engineering Education and i-STEM Education programs are in high demand.

Program Entrance, Retention and Exit Standards for the Technological Studies Programs

(1) Technology/Pre-Engineering Education (Undergraduate-Secondary)

Retention in this program is based on the following performance standards in these "critical content courses": MAT127 (C-), PHY201 (C-), ETE131 (C), ETE271 (C), TED280 (C). A student who does not achieve these minimum performance standards and/or earns a grade of F in any other in-major course will be placed on the Engineering Programs Retention List. The State of New Jersey currently requires a cumulative GPA of at least 3.00 for students to be recommended for certification, and a department requirement is that students in this

major must maintain a GPA of at least 2.33 for any single academic semester. Students who do not achieve these minimum GPA milestones will be placed on the Engineering Programs Retention List. Placement on the Retention List for two consecutive semesters or any three non-consecutive semesters will result in dismissal from the major. Students dismissed from the major may appeal for re-entry into the major. Students dismissed from the major may not enroll in School of Engineering offerings with the exception of offerings that meet Liberal Learning program requirements. Entrance (internal transfer) into this program from another program within the College is based upon the following performance standards in these “foundation courses”: MAT127 (C-), PHY201 (C-). Internal transfer within engineering programs will be permitted as long as enrollment limits are not exceeded.

(2) K-6 Integrative-STEM Education (Undergraduate-Primary)

Retention in this program is based on the following performance standards in these “critical content courses”: MAT127 (C-), ETE271 (C). A student who does not achieve these minimum performance standards and/or earns a grade of F in any other in-major course will be placed on the Engineering Programs Retention List. In-major courses for this major are any professional (education/methods) or content (STEM) course required for the integrative-STEM Education major, including Specialization courses. Starting in Spring-2016 TCNJ will require a cumulative GPA of 3.0 GPA for TCNJ to recommend the student for certification to the State. The department’s requirement is that students in this major must maintain a GPA of at least 2.33 for any single academic semester. Students who do not achieve this minimum GPA milestone 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 this program from another program within the College is based upon the following performance standards in these “foundation courses”: MAT127 (C-), TST161 (B-), ETE261 (B-) and MAT105 (C). Internal transfer within engineering programs will be permitted as long as enrollment limits are not exceeded.

Program Course Sequences

(1) Technology/Pre-Engineering Education (Undergraduate-Secondary)

Candidates for a teacher-education certificate must have a cumulative grade point average of at least 2.75 to complete the teaching preparation program, and should have a 2.75 cumulative GPA to enter their junior professional experience. They also must meet the state hygiene/physiology requirement; the state Harassment, Intimidation, and Bullying Prevention (HIB) training certificate requirement, and pass the appropriate PRAXIS examination before the New Jersey State Department of Education will issue the appropriate certificate. Teacher-education candidates will receive a “certificate of eligibility with advanced standing” which requires a candidate to be provisionally certified for his or her first year of teaching. After one year of successful teaching, the candidate is eligible for a permanent certificate. Students should consult with their departmental advisers in planning their academic program. These plans should take into account requirements for the major, general education, professional courses, and state certification. All teacher candidates are officially accepted into the teacher education program as rising juniors. Entrance requirements include a cumulative 2.75 GPA, demonstration of basic skills competency (qualifying SAT, ACT, or Praxis Core scores), and satisfaction of departmental

requirements. In order to be eligible for *institutional recommendation* for teacher certification, all candidates must successfully complete program requirements, attain a 3.0 cumulative GPA, and earn a minimum student teaching grade of B-. The department also requires a minimum grade of a B- in TED 380 and TED 480, as well as a minimum grade of a C+ in TED 280.

Required Major Courses (Content)

TST	161/Creative Design
MAT	127/Calculus A
PHY	201/General Physics I
ETE	111/Engineering Design
ETE	131/Engineering Math (counts toward NJDOE Middle School Math Endorsement)
ETE	261/Multimedia Design
ETE	271/Structures and Mechanics
ETE	275/Mechanics and Materials
ETE	281/Analog Circuits and Devices
ETE	341/Environmental and Biotechnology Systems
ETE	361/Architectural and Civil Engineering Design
ETE	365/Prototyping Lab (0.5 unit)
ETE	371/Mechanical Systems Design
ETE	381/Digital Electronics
ETE	385/Controls & Robotics (0.5 unit)
ETE	395/Sr. Design Proposal (0.5 unit)
ETE	461/Manufacturing Systems,
ETE	492/Facilities Design and Management
ETE	495/Sr. Design Proposal

Required Major Courses (Professional)

TED	280/Introduction to Teaching Technology & Engineering Education
TED	380/Junior Professional Experience
TED	460/Integrated STEM for the Child/Adolescent Learner
TED	480/481/490 Content & Methods/ Seminar/ Student Teaching

Required Education Courses

SPE	203 Psych. Child./ Adole. Development
SPE	323 Inclusion/ Disabilities

Suggested Course Sequence Technology/Pre-Engineering Education

First Year (by advisement)

FSP	First Seminar	1 course unit
MAT	127/Calculus A	1 course unit
TST	161/Creative Design	1 course unit
ETE	261/Multimedia Design	1 course unit
PHY	201/General Physics I	1 course unit
ETE	111/Engineering Design	1 course unit
ETE	131/Engineering Math	1 course unit
WRI	102/Academic Writing (if not exempt)*	1 course unit

Total for year

8 course units

**It is recommended that students exempted from this course take other liberal learning courses.*

Technology Minor

The minor consists of five units:

Required: TST 161/Creative Design

And select four of the following courses (with at least one 300-level course):

- ETE 111/Engineering Design
- ETE 131/Engineering Math (counts toward NJDOE Middle School Math Endorsement)
- ETE 261/Multimedia Design
- ETE 271/Structures and Mechanics
- ETE 275/Mechanics & Materials
- ETE 281/Analog Circuits and Devices
- ETE 341/Environmental and Biotechnology Systems
- ETE 361/Architectural and Civil Engineering Design
- ETE 381/Digital Electronics
- ETE 461/Manufacturing Systems

(2) Integrative-STEM Education (Undergraduate-Primary)

This disciplinary (second) major is open to all K-6 education majors [(i) Elementary Education (ii) Early Childhood, (iii) Special Education, (iv) Deaf and Hard of Hearing and (v) Urban Education]

Required Major Courses (Content)

- TST 161/Creative Design
- MAT 127/Calculus A
- ETE 261/Multimedia Design
- ETE 271/Structures and Mechanics
- TED 460/Integrated STEM for the Child/Adolescent Learner

Note 1: There are other required courses in Math, Science and/or Technology/ Engineering Education but depend on which Specialization a student chooses.

Note 2: A student is required to choose an area of (STEM) Specialization.

Note 3: There are 5 choices for a specialization: (i) Technology/pre-engineering education, (ii) Mathematics, (iii) Biology, (iv) Chemistry and (v) Physics.

Note 4: Three education endorsements are possible, and often completed with the i-STEM major; (i) Middle school mathematics, (ii) Middle school science and (iii) Secondary technology/pre-engineering education.

Suggested Course Sequence integrative STEM Education**Freshman Year (by advisement)**

- FSP First Seminar
- MAT 127/Calculus A
- TST 161/Creative Design
- ETE 261/Multimedia Design
- Science Option #1 (by advisement)
- MAT 105/Mathematical Structures & Algorithms for Education I
(or MAT 106/Mathematical Structures & Algorithms for Education II)
- WRI 102/Academic Writing (if not exempt)*

**It is recommended that students exempted from this course take another liberal learning course.*