

School of Engineering

Dean: George N. Facas

The School of Engineering is composed of two departments, engineering and technological studies. Graduates of the engineering program are prepared for employment at the professional level or to pursue graduate studies. The program in technological studies prepares students for positions in business, industry, and government or to be teachers of technology education.

The engineering program prepares students for careers in research and development, design, and engineering practice. The engineering program equips our graduates for entry-level positions as engineers in industry and places them on track for professional registration. The course of study in engineering will provide the opportunity to study an engineering specialty in one of the following engineering disciplines: computer, electrical, or mechanical engineering, or engineering management. The program also prepares a student for admission to graduate school to continue his or her education toward the MS or PhD in a recognized engineering or other technical specialty and other related advanced degrees.

Engineering

Faculty: Czeto, Chair; Asper, Bittner, Chang, Facas, Flynn, Grega, Hess, Katz, Kurland, Riederer, Sepahpour, Shelley, C.T. Shih, W.T. Shih, Tebbe

The engineering science curriculum provides each student with a thorough understanding of why and how things work. It develops the ability to predict the effect on a proposed or existing design of different choices in the use of materials, form, and procedures. The curriculum is built on a core of general studies taken from many disciplines and taught by experts in those specific fields of study. It is also firmly based on a study of fundamental concepts in mathematics and physical sciences and is taught at a high level of intellectual challenge. The curriculum provides exposure to the theory of engineering and design that underlies all engineering specialties, while offering the student the opportunity to explore a particular engineering specialty in depth.

The TCNJ engineering program provides students with considerable exposure to laboratory experiences and is supported by excellent laboratory resources. Laboratory activities help develop skills in original design and develop a student's confidence in his or her ability to critique and improve a design. The engineering program at TCNJ is limited to undergraduate studies. Laboratories, therefore, are designed specifically for teaching, are relevant to the course material, and are kept accessible for students.

The engineering science program at TCNJ is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.

Mission Statement

The mission of the engineering department is to provide the student with a foundation in engineering and the underlying mathematics and sciences. The graduate of this program will have a mastery of engineering science and design which will enable him/her to pursue a successful career or continue graduate studies.

To achieve this mission within the context of a comprehensive liberal arts college that emphasizes small classes and attention to individual needs, the engineering department has established the following educational objectives:

1. To provide the students with the mathematical, computational, engineering, and communications skills necessary for the pursuit of a successful career;
2. To ensure that the students receive a broad engineering education, so that they can think across disciplines, while being able to specialize in a supported engineering area;
3. To foster the students' abilities to formulate problems, find practical and responsible solutions, and understand the impact of solutions within a global/societal context in a collaborative environment;
4. To develop the students' ability to design a system, component, or process that meets a desired need while encompassing economic, ethical, environmental, and human issues;
5. To develop the students' ability to design and conduct experiments, to analyze and interpret data, and to communicate the results effectively;
6. To develop the students' ability to use modern engineering tools and techniques in the design process;
7. To instill in the students a knowledge of diverse cultures, ethical and contemporary issues, and involvement in professional and community activities; and
8. To prepare the students for lifelong learning, and encourage and promote professional registration.

Academic Policies and Standards

A student may repeat any course without seeking approval. If a student wishes to repeat a course more than once, permission must be obtained from the chair of the engineering department 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, i.e., 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 are required to take the Fundamentals of Engineering Examination for the Professional Engineer's License. Given the nature of the engineering curriculum, it is extremely important to follow the recommended course sequence. Violations of this guideline may result in dismissal from the engineering major.

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. Minimum grades are noted in parentheses.

- Retention in the program is based on the following performance standards in these "critical content courses": PHYS 201 (C-); PHYS 202 (C-)
- Transfer into the program from another program within The College is based upon the following performance standards in these "foundation courses": RHET 101 (C+)

- Graduation requires a GPA of 2.0 in courses for the program and earning a minimum grade of C- in the following courses: A student who has received two or more Ds or Fs in major courses will be subject to review by the departmental retention committee.

Engineering Program

Computer Engineering Specialization

Freshman Year

Fall

RHET	101/Rhetoric I	3
MATH	127/Calculus I	3
PHYS	201/General Physics I	4
CHEM	201/General Chemistry I	4
ENGR	142/Fundamentals of Engineering Design	3
ENGR	095/Introduction to Engineering	0
ENGR	091/Engineering Seminar I	0

Spring

RHET	102/Rhetoric II/Technical Writing	3
MATH	128/Calculus II	3
PHYS	202/General Physics II	4
IDSC	151/Athens to New York	3
STEC	161/Creative Design	3
ENGR	092/Engineering Seminar II	0
Total for year		33

Sophomore Year

Fall

MATH	229/Calculus III	3
MATH	386/Differential Equations	3
ENGR	312/Digital Circuits and Microprocessors	3
CMSC	210/Discrete Structures of Computer Science	3
CMSC	220/Computer Science I	4

Spring

ENGR	212/Circuit Analysis	3
ENGR	214/Circuit Analysis Laboratory	1
ENGR	272/Advanced Engineering Mathematics I	3
CMSC	230/Computer Science II	4
ELEC	321/Systems and Signals	3
ECON	200/Principles of Economics: Micro	3
Total for year		33

Junior Year

Fall

ELEC	251/Electronics	3
ELEC	333/Electrical Engineering Lab I	1
ELEC	443/Microcomputer Systems	2
ENGR	093/Engineering Seminar III	0
ENGR	222/Statics	3
CMSC	340/Computer Science III	4
IDSC	252/Society, Ethics, and Technology	3

Spring

ELEC	361/Digital Signal Processing	3
ELEC	363/Electrical Engineering Lab II	1
ELEC	451/Computer Architecture and Organization	3
ENGR	094/Engineering Seminar IV	0
ENGR	262/Dynamics	3
ENGR	372/Engineering Economy	3
	History	3
Total for year		32

Senior Year**Fall**

ELEC	411/Embedded Systems	3
ELEC	495/Senior Project I	1
ENGR	099/Senior Professional Seminar	0
ENGR	352/Control Systems I	3
ENGR	354/Control Systems Laboratory	1
CMSC	330/Operating Systems	3
	Restricted Specialization Elective**	3
	Social Sciences (content)	3

Spring

ELEC	496/Senior Project II	3
ENGR	098/Fundamentals of Engineering Review	0
ENGR	322/Thermodynamics I	3
ENGR	342/Advanced Engineering Math II	3
	Restricted Specialization Elective**	3
	Philosophy/Religion	3
	Literature	3

Total for year 35
Total 133

**By advisement only.

Electrical Engineering Specialization**Freshman Year****Fall**

RHET	101/Rhetoric I	3
MATH	127/Calculus I	3
PHYS	201/General Physics I	4
CHEM	201/General Chemistry I	4
ENGR	142/Fundamentals of Engineering Design	3
ENGR	095/Introduction to Engineering	0
ENGR	091/Engineering Seminar I	0

Spring

RHET	102/Rhetoric II/Technical Writing	3
MATH	128/Calculus II	3
PHYS	202/General Physics II	4
IDSC	151/Athens to New York	3
STEC	161/Creative Design	3
ENGR	092/Engineering Seminar II	0

Total for year 33

Sophomore Year**Fall**

MATH	229/Calculus III	3
MATH	386/Differential Equations	3
ENGR	312/Digital Circuits and Microprocessors	3
CMSC	210/Discrete Structures of Computer Science	3
CMSC	220/Computer Science I	4

Spring

ENGR	212/Circuit Analysis	3
ENGR	214/Circuit Analysis Laboratory	1
ENGR	272/Advanced Engineering Mathematics I	3
ENGR	222/Statics	3
ELEC	321/Systems and Signals	3
ECON	200/Principles of Economics: Micro	3

Total for year 32

Junior Year**Fall**

ELEC	251/Electronics	3
ELEC	333/Electrical Engineering Lab I	1

ELEC	443/Microcomputer Systems	2
ENGR	093/Engineering Seminar III	0
ENGR	262/Dynamics	3
ENGR	342/Advanced Engineering Mathematics II	3
IDSC	252/Society, Ethics, and Technology	3

Spring

ELEC	341/Communication Systems	3
ELEC	361/Digital Signal Processing	3
ELEC	363/Electrical Engineering Lab II	1
ELEC	373/Electrical Engineering Lab III	2
ELEC	451/Computer Architecture and Organization	3
ENGR	094/Engineering Seminar IV	0
ENGR	372/Engineering Economy	3
	History	3

Total for year 33

Senior Year**Fall**

ELEC	411/Embedded Systems	3
ELEC	423/Engineering Electromagnetics	3
ELEC	495/Senior Project I	1
ENGR	099/Senior Professional Seminar	0
ENGR	352/Control Systems I	3
ENGR	354/Control Systems Laboratory	1
	Restricted Electrical Engineering Elective**	3
	Social Sciences (content)	3

Spring

ELEC	441/Advanced Digital Design	3
ELEC	496/Senior Project II	3
ENGR	098/Fundamentals of Engineering Review	0
ENGR	322/Thermodynamics I	3
	Restricted Electrical Engineering Elective**	3
	Literature	3
	Philosophy/Religion	3

Total for year 35

Total 133

**By advisement only.

Engineering Management/EE Preference**Freshman Year****Fall**

RHET	101/Rhetoric I	3
MATH	127/Calculus I	3
PHYS	201/General Physics I	4
CHEM	201/General Chemistry I	4
ENGR	142/Fundamentals of Engineering Design	3
ENGR	095/Introduction to Engineering	0
ENGR	091/Engineering Seminar I	0

Spring

RHET	102/Rhetoric II/Technical Writing	3
MATH	128/Calculus II	3
PHYS	202/General Physics II	4
CMSC	215/Computer Programming	3
STEC	161/Creative Design	3
ENGR	092/Engineering Seminar II	0

Total for year 33

Sophomore Year**Fall**

MATH	229/Calculus III	3
MATH	386/Differential Equations	3

ENGR	232/Manufacturing Processes	3
ENGR	312/Digital Circuits and Microprocessors	3
ENGR	222/Statics	3
PSYC	101/General Psychology	3

Spring

ENGR	152/Engineering Materials Science	3
ENGR	212/Circuit Analysis	3
ENGR	214/Circuit Analysis Laboratory	1
ENGR	272/Advanced Engineering Mathematics I	3
ACCT	260/Accounting Principles I	3
ELEC	321/Systems and Signals	3
Total for year		34

Junior Year**Fall**

ELEC	251/Electronics	3
ELEC	333/Electrical Engineering Lab I	1
MECH	321/Numerical Analysis	3
ENGR	093/Engineering Seminar III	0
ENGR	262/Dynamics	3
ENGR	342/Advanced Engineering Mathematics II	3
IDSC	151/Athens to New York	3
ECON	200/Principles of Economics: Micro	3

Spring

ELEC	341/Communication Systems	3
ENGR	094/Engineering Seminar IV	0
ENGR	372/Engineering Economy	3
ECON	201/Principles of Economics: Macro	3
MGMT	310/Management of Organizational Behavior	3
IDSC	252/Society, Ethics, and Technology	3
Total for year		34

Senior Year**Fall**

ELEC	495/Senior Project I	1
ENGR	099/Senior Professional Seminar	0
ENGR	352/Control Systems I	3
ENGR	354/Control Systems Laboratory	1
BUSN	217/Legal Environment of Business	3
MKTG	340/Marketing Principles	3
	Restricted Electrical Engineering Elective**	3
	Philosophy/Religion	3

**By advisement only.

Spring

ELEC	496/Senior Project II	3
ENGR	098/Fundamentals of Engineering Review	0
ENGR	322/Thermodynamics I	3
ENGR	452/Project Management	3
	Literature	3
	History	3
Total for year		32
Total		133

Engineering Management/ME Preference**Freshman Year****Fall**

RHET	101/Rhetoric I	3
MATH	127/Calculus I	3
PHYS	201/General Physics I	4
CHEM	201/General Chemistry I	4

ENGR	142/Fundamentals of Engineering Design	3
ENGR	095/Introduction to Engineering	0
ENGR	091/Engineering Seminar I	0

Spring

RHET	102/Rhetoric II/Technical Writing	3
MATH	128/Calculus II	3
PHYS	202/General Physics II	4
CMSC	215/Computer Programming (FORTRAN)	3
STEC	161/Creative Design	3
ENGR	092/Engineering Seminar II	0
Total for year		33

Sophomore Year**Fall**

MATH	229/Calculus III	3
MATH	386/Differential Equations	3
ENGR	232/Manufacturing Processes	3
ENGR	212/Circuit Analysis	3
ENGR	214/Circuit Analysis Laboratory	1
ENGR	222/Statics	3

Spring

ENGR	152/Engineering Materials Science	3
ENGR	262/Dynamics	3
ENGR	272/Advanced Engineering Mathematics I	3
ACCT	260/Accounting Principles I	3
IDSC	151/Athens to New York	3
PSYC	101/General Psychology	3
Total for year		34

Junior Year**Fall**

MECH	321/Numerical Analysis	3
ENGR	093/Engineering Seminar III	0
ENGR	322/Thermodynamics I	3
ENGR	342/Advanced Engineering Mathematics II	3
IDSC	252/Society, Ethics, and Technology	3
BUSN	217/Legal Environment of Business	3
ECON	200/Principles of Economics: Micro	3

Spring

MECH	251/Strength of Materials	3
MECH	263/Mechanical Engineering Lab I	1
ENGR	094/Engineering Seminar IV	0
ENGR	372/Engineering Economy	3
ECON	201/Principles of Economics: Macro	3
MGMT	310/Management of Organizational Behavior	3
	Literature	3
Total for year		34

Senior Year**Fall**

MECH	311/Mechanical Design Analysis I	3
MECH	495/Senior Project I	1
ENGR	099/Senior Professional Seminar	0
ENGR	352/Control Systems I	3
ENGR	354/Control Systems Laboratory	1
MKTG	340/Marketing Principles	3
	Restricted Mechanical Engineering Elective**	3
	Philosophy/Religion	3

**By advisement only.

Spring

MECH 361/Fluid Mechanics	3
MECH 496/Senior Project II	3
ENGR 098/Fundamentals of Engineering Review	0
ENGR 312/Digital Circuits and Microprocessors	3
ENGR 452/Project Management	3
History	3

Total for year 32
Total 133

Mechanical Engineering Specialization**Freshman Year****Fall**

RHET 101/Rhetoric I	3
MATH 127/Calculus I	3
PHYS 201/General Physics I	4
CHEM 201/General Chemistry I	4
ENGR 142/Fundamentals of Engineering Design	3
ENGR 095/Introduction to Engineering	0
ENGR 091/Engineering Seminar I	0

Spring

RHET 102/Rhetoric II/Technical Writing	3
MATH 128/Calculus II	3
PHYS 202/General Physics II	4
CMSC 215/Computer Programming (FORTRAN)	3
STEC 161/Creative Design	3
ENGR 092/Engineering Seminar II	0

Total for year 33

Sophomore Year**Fall**

MATH 229/Calculus III	3
MATH 386/Differential Equations	3
ENGR 232/Manufacturing Processes	3
ENGR 212/Circuit Analysis	3
ENGR 222/Statics	3
ENGR 214/Circuit Analysis Laboratory	1

Spring

ENGR 152/Engineering Materials Science	3
ENGR 262/Dynamics	3
ENGR 272/Advanced Engineering Mathematics I	3
MECH 251/Strength of Materials	3
MECH 263/Mechanical Engineering Lab I	1
IDSC 151/Athens to New York	3

Total for year 32

Junior Year**Fall**

MECH 311/Mechanical Design Analysis I	3
MECH 321/Numerical Analysis	3
ENGR 093/Engineering Seminar III	0
ENGR 322/Thermodynamics I	3
ENGR 342/Advanced Engineering Mathematics II	3
ECON 200/Principles of Economics: Micro	3
IDSC 252/Society, Ethics, and Technology	3

Spring

MECH 361/Fluid Mechanics	3
MECH 363/Mechanical Engineering Laboratory II	1
MECH 371/Thermodynamics II	3
ENGR 094/Engineering Seminar IV	0
ENGR 372/Engineering Economy	3

Restricted Mechanical Engineering Elective**	3
Social Sciences (content)	3
Total for year	34

Senior Year**Fall**

MECH 411/Heat Transfer	3
MECH 433/Mechanical Engineering Laboratory III	1
MECH 495/Senior Project I	1
ENGR 099/Senior Professional Seminar	0
ENGR 352/Control Systems I	3
ENGR 354/Control Systems Laboratory	1
Restricted Mechanical Engineering Elective**	3
Literature	3
Philosophy/Religion	3

Spring

MECH 460/Computer-Aided Mechanical Engr. Design	3
MECH 463/Mechanical Engineering Laboratory IV	1
MECH 496/Senior Project II	3
ENGR 098/Fundamentals of Engineering Review	0
ENGR 312/Digital Circuits and Microprocessors	3
Restricted Mechanical Engineering Elective**	3
History	3
Total for year	34
Total	133

**By advisement only.

General Engineering Courses**ENGR 091, 092/Engineering Seminar I, II** **Fr. Yr.**

Students in the freshman year are expected to engage in appropriate professional and service activities over two semesters. Activities such as attendance at technical presentations, professional society functions, service activities, and professional membership are required. (P/U)

ENGR 093, 094/Engineering Seminar III, IV **Jr. Yr.**

The requirement for professional and/or service activities (ENGR 091, 092) is repeated for students in the junior year. (P/U)

ENGR 095/Introduction to Engineering **0 cr.**

(1 class hour)
(fall semester)

The course provides an introduction to the engineering profession. Students are provided with an orientation to the program as well as the engineering specializations offered by the department. Areas of study include academic success strategies, time management, and the development of skills needed for successful group work. (P/U)

ENGR 098/Fundamentals of Engineering Review **0 cr.**

(3 class hours)
(spring semester)

Prerequisite: Senior standing

A review of engineering principles in preparation for the Fundamentals of Engineering (FE) Certification Examination. (P/U)

ENGR 099/Senior Professional Seminar **0 cr.**

(1 class hour)
(fall semester)

Prerequisite: Senior standing

Orientation course to aid students making the transition from college to graduate school/industry. Topics include ca-

reer planning, resume preparation, interviewing techniques, professional responsibilities, ethics, graduate and continuing education. (P/U)

ENGR 142/Fundamentals of Engineering Design 3 cr.
(3 class hours, 1 lecture/design hour)
(every semester)

An introduction to the study of engineering design as set within the graphical context of computer-aided engineering software and the procedural context of reverse engineering. Activities include the graphical analysis of the engineering design of products for visualization and communication, utilizing parametric solid modeling and also reverse engineering problems requiring the adaptation of an existing design.

ENGR 152/Engineering Materials Science 3 cr.
(2 class hours, 3 lab hours)
(every semester)

Corequisite: CHEM 201

Fundamentals of metallurgy and properties of engineering materials, including ferrous and nonferrous metals, plastics, and wood.

ENGR 212/Circuit Analysis 3 cr.
(3 class hours)
(every semester)

Prerequisite: PHYS 202

Corequisite: MATH 386

Electric circuit concepts, Kirchoff's laws, node and mesh analysis, network theorems, natural and forced response, steady state analysis, phasor notation, balanced 3 phase, Fourier series, and frequency selective networks.

ENGR 214/Circuit Analysis Laboratory 1 cr.
(3 lab hours)
(every semester)

Corequisite: ENGR 212

A practical laboratory experience designing, simulating, breadboarding, and testing electric circuits to complement the theory in ENGR 212.

ENGR 222/Statics 3 cr.
(3 class hours, 1 recitation hour)
(every semester)

Prerequisite: PHYS 201

Corequisite: MATH 229

Analysis of force systems and applications to structural analysis. Force analysis of plane trusses and frames, friction effects, centroids and moments and products of inertia of plane areas and curves.

ENGR 232/Manufacturing Processes 3 cr.
(2 class hours, 3 lab hours)
(every semester)

An introduction to the basic tools, processes, and materials of manufacturing. The manufacturing enterprise is examined with special attention to key organizational systems including production and inventory control, quality control, marketing, and finance. In addition, fundamental processes of the metals and plastics industries are treated in depth.

ENGR 252/Electronic Devices and Circuits 3 cr.
(3 class hours, 1 recitation hour)
(every semester)

Prerequisite: ENGR 212

The study of electronic devices including the operational amplifier, the diode, the bipolar junction transistor, and the field-effect transistor and the analysis of basic electronic circuits.

ENGR 262/Dynamics 3 cr.
(3 class hours, 1 recitation hour)
(every semester)

Prerequisite: ENGR 222

Displacement, velocity, and acceleration of a particle. Dynamics of particles and rigid bodies. Work-energy and impulse momentum methods for particles and rigid bodies.

ENGR 272/Advanced Engineering Mathematics I 3 cr.
(3 class hours)
(every semester)

Prerequisite: MATH 128

Introduction to matrix algebra and probability. Topics include: linear systems, basis, vectors, matrices, eigenvalue-eigenvector problems, probability, continuous and discrete distributions, simple and multiple regression and correlation, and experimental design.

ENGR 312/Digital Circuits and Microprocessors 3 cr.
(3 class hours, 1 recitation hour)
(every semester)

Corequisite: CMSC 215 or CMSC 220 or permission of the instructor

Analysis and design of digital systems including Boolean algebra, combinational and sequential circuit designs, programmable logic devices, VHDL, CMOS logic circuits, and computer basics.

ENGR 322/Thermodynamics I 3 cr.
(3 class hours, 1 recitation hour)
(every semester)

Prerequisites: PHYS 202, CHEM 201

Corequisite: ENGR 222

Study of the thermodynamic properties of pure substances, relationship of pressure and temperature to thermodynamic properties, concepts of work and heat. First and second laws of thermodynamics. Process and cycle analysis.

ENGR 342/Advanced Engineering Mathematics II 3 cr.
(3 class hours)
(every semester)

Prerequisites: MATH 229, MATH 386, ENGR 272

Advanced Vector Calculus, Greens, Stokes, and Divergence theorems. Lagrange multipliers and optimization. Fourier series, periodic functions, functions of arbitrary period, even and odd functions, and half-range expansions. Solutions to second order partial differential equations.

ENGR 352/Control Systems I 3 cr.
(3 class hours, 1 recitation hour)
(every semester)

Prerequisite: ENGR 212

A study of theory and applications of electrical analog and digital control systems. Emphasis is on study of specific applications of such control systems to industrial processes and especially their application to electrical, hydraulic, pneumatic, and mechanical systems.

ENGR 354/Control Systems Laboratory 1 cr.
(3 lab hours)
(every semester)

Corequisite: ENGR 352

Designing, modeling, and the simulation of analog and digital controllers.

- ENGR 372/Engineering Economy** 3 cr.
(3 class hours)
(every semester)
Prerequisites: MATH 128, ECON 200
Economic and financial considerations in engineering decisions. Topics include decision criteria. Also, cost concepts, financial calculations, capital sources, accounting data, depreciation, breakeven analysis, effect of taxes, and intangible factors. Students will also become familiar with the common cost accounting systems and applications, their strengths and weaknesses.
- ENGR 412/Process and Quality Control** 3 cr.
(3 class hours, 1 recitation hour)
(occasionally)
Prerequisites: ENGR 232, and ENGR 272 or equivalent
Industrial practices with respect to the control of quality of manufactured products including standards, inspection, organization, sampling, and corrective action. The use of inspection instruments and procedures is included.
- ENGR 452/Project Management** 3 cr.
(3 class hours)
(spring semester)
Prerequisite: ENGR 272
This course presents the methods of project management at an introductory level. Techniques in project initiation and project implementation are discussed. Topics include project selection, project organization, project planning, budgeting and cost estimation, scheduling, resource allocation, project control, and project auditing.
- ENGR 472/Special Topics in Engineering** 3 cr.
(3 class hours)
(every semester)
Prerequisite: Permission of instructor
Study of advanced topics in engineering chosen by the instructor.
- Electrical Engineering Specialization Courses**
- ELEC 251/Electronics** 3 cr.
(3 class hours, 1 design/recitation hour)
(fall semester)
Prerequisite: ENGR 212
Introduction to electronic devices and related circuits. Topics include diodes, bipolar junction and field-effect transistors, operational amplifiers, and related integrated circuit components.
- ELEC 321/ Systems and Signals** 3 cr.
(3 class hours, 1 design/recitation hour)
(spring semester)
Prerequisite: MATH 386
Continuous and discrete signals and systems. Convolution, impulse response, system classifications, differential and difference equations. Fourier series, Fourier transform, Laplace transform, x-transform. Transfer functions and stability.
- ELEC 333/Electrical Engineering Lab I** 1 cr.
(3 lab hours)
(fall semester)
Corequisite: ELEC 251
A practical laboratory experience designing, simulating, breadboarding and testing electronic circuits to complement the theory in ELEC 251.
- ELEC 341/Communication Systems** 3 cr.
(3 class hours, 1 design/recitation hour)
(spring semester)
Prerequisites: ELEC 251, ELEC 321
Digital and analog communication systems including baseband, pulse, AM, FM, and digital modulated systems.
- ELEC 361/Digital Signal Processing** 3 cr.
(3 class hours, 1 design/recitation hour)
(spring semester)
Prerequisites: ENGR 312, ELEC 321
Sampling data systems, z-transform, DFT, FFT, and digital filter design with applications to digital signal processing.
- ELEC 363/Electrical Engineering Lab II** 1 cr.
(3 lab hours)
(spring semester)
Corequisite: ELEC 361
The integration of theory, computer simulation, and experimental laboratory work as applied to digital filters.
- ELEC 373/Electrical Engineering Lab III** 2 cr.
(1 class hour, 3 lab hours)
(spring semester)
Corequisite: ELEC 341
Design issues and modeling techniques in communication transmission systems. Experiments include linear, nonlinear, and digital modulation/demodulation and computer-aided design.
- ELEC 411/Embedded Systems** 3 cr.
(3 class hours, 1 design/recitation hour)
(fall semester)
Prerequisites: ELEC 251, ELEC 361, ELEC 443
This course deals with embedded systems and their interactions with their physical environments. It focuses on embedded system design issues such as limited memory, cost, performance guarantees, real-time operations, power and reliability.
- ELEC 421/Control Systems II** 3 cr.
(3 class hours, 1 design/recitation hour)
(occasionally)
Prerequisites: ENGR 352
Analog and digital control systems, dynamic response modeling, design, and compensation techniques.
- ELEC 423/Engineering Electromagnetics** 3 cr.
(3 class hours)
(fall semester)
Prerequisites: ENGR 342, PHYS 202
An integration of theory and practical applications in electromagnetics, transmission lines, and electromagnetic fields and waves. Includes impedance matching, Smith Chart, CAD tools and waveguides.
- ELEC 431/RF/Microwave Engineering** 3 cr.
(3 class hours, 1 design/recitation hour)
(occasionally)
Prerequisite: ELEC 423
Extension of Engineering Electromagnetics. Additional topics in RF transmission systems, active devices, amplifier design using scattering parameters and modern filter design.

- ELEC 441/Advanced Digital Design** 3 cr.
(3 class hours, 1 design/recitation hour)
(spring semester)
Prerequisites: ENGR 312, ELEC 251
Treatment of digital system engineering problems: power, noise, signaling, and timing.
- ELEC 443/Microcomputer Systems** 2 cr.
(1 class hour, 3 lab hours)
(fall semester)
Prerequisite: ENGR 312
An introductory course in microcontrollers, microprocessors and embedded control architecture assembly language programming, and interfacing of external devices with microcontrollers is emphasized.
- ELEC 451/Computer Architecture and Organization** 3 cr.
(3 class hours, 1 design/recitation hour)
(spring semester)
Prerequisites: ENGR 312, ELEC 443
Microprocessor design philosophy, data typing and addressing modes, multi-processors, multi-tasking, process communications, memory management, and virtual memory.
- ELEC 471/VLSI Design** 3 cr.
(3 class hours, 1 design/recitation hour)
(occasionally)
Prerequisites: ENGR 312, ELEC 251 ELEC 451
Structured design methodologies for VLSI systems. Topics include switching models, device equations, combinational and sequential systems design, simulation, timing, verification and tools for computer-aided design.
- ELEC 481/Robotics** 3 cr.
(3 class hours, 1 design/recitation hour)
(occasionally)
Prerequisite: ENGR 352
Introduction to all aspects of robotics with emphasis on industrial applications; study of different methods of robot actuation and feedback control mechanism; analysis of robot operation along with associated control languages and student design projects related to robotic technology.
- ELEC 492/Independent Study** 1–3 cr.
(3 class hours, 1 design/recitation hour)
(occasionally)
Prerequisites: Permission of instructor and department, senior status required
For advanced students wishing to pursue a special area of interest. Topic(s) developed in consultation with a faculty adviser.
- ELEC 495, 496/Senior Project I, II** 1, 3 cr.
(3 class hours, 1 design/recitation hour)
(every semester)
Prerequisites: Senior standing and approved project proposal
Senior project focuses students' previous experience upon a specific technical project. Library research, design, cost analysis, construction, testing, and project management. Students work closely with a faculty adviser.
- Industrial Engineering Specialization Courses**
- INDU 251/Production and Inventory Control** 3 cr.
(2 class hours, 3 lab hours)
Prerequisite: ENGR 232
Sophomore-level integrated design experience. Includes a design project based on engineering theoretical content.
- Topics include functional organization of manufacturing operations; classes and reasons for inventories; manufacturing control systems; computer data requirements and base management; production scheduling; introduction to the MRP algorithm; formal methods of forecasting.
- INDU 301/Mathematical Methods for IE Analysis** 3 cr.
(2 class hours, 2 recitation hours)
Prerequisite: MATH 286
The application of statistics to the effective design and analysis of industrial studies. Topics include experimental design; hypothesis testing; one-factor designs; prior- and post-hoc tests; factorial experiments; nested factorial experiments; linear, curvilinear, and multiple regression; fractional replication; and an introduction to the application of non-parametric statistics.
- INDU 311/Operations Research** 4 cr.
(2 class hours, 2 recitation hours)
Prerequisites: INDU 251, MATH 286 or equivalent
Development of mathematical models of solving decision problems of a deterministic nature. Classical optimization, linear programming (product mix and distribution problems). Network procedures, game theory, and queuing theory are used. Introduction to dynamic programming and integer programming with examples from industrial engineering. Extensive use of computer in problem solving. Emphasis is on applications.
- INDU 341/Ergonomics and Human Biomechanics** 4 cr.
(3 class hours, 3 lab hours)
Prerequisite: MATH 286
Junior-level integrated design experience. Includes a design project based on engineering theoretical content. Topics include muscular work and improvement of work efficiency, anthropometric, human-machine systems and human-computer interaction, cumulative trauma, occupational stress and cognition. Course includes review of topics in human anatomy and physiology with emphasis on the musculo-skeletal system.
- INDU 371/System Simulation** 4 cr.
(3 class hours, 3 lab hours)
Prerequisites: INDU 251, INDU 311, MATH 286 or equivalent
Junior-level integrated design experience. Includes a design project based on engineering theoretical content. Topics include basic concepts of system, subsystem, model; deterministic and stochastic processes; utilization of probability theory and mathematical analysis for model and simulation design; practical application of various simulation languages to diverse systems.
- INDU 411/Work Data Acquisition and Measurement** 4 cr.
(3 class hours, 3 lab hours)
Prerequisite: INDU 251
Fundamentals of work analysis, time study and work measurement practice. Stopwatch time study, micromotion study, establishment of allowances by stopwatch and work-sampling studies. Construction and use of work measurement formulae. Time study and development of standard data using techniques based on use of predetermined times.
- INDU 451/Human Factors Engineering** 4 cr.
(3 class hours, 1 design/recitation hour)
Prerequisites: INDU 341 and INDU 301
Human-machine systems analysis and design including criteria for display and control design or selection, workplace

layout for normal or stressful occupations, design to compensate for effects of normal fatigue and environmental influences on performance including effects of illumination, noise, vibration, temperature, humidity, etc. NIOSH and OSHA regulations and published research findings relative to accident prevention are discussed. Methods of performing experimentation in Human Factors Engineering.

INDU 471/Computer Methods in IE Analysis 4 cr.
(3 class hours, 1 design/recitation hour)

Prerequisite: INDU 301

Study of applications of regression theory, linear and non-linear models, and analysis of variance. Design and analysis of experiments and statistical analysis with nonparametric methods.

INDU 481/Facilities Layout and Design 4 cr.
(3 class hours, 1 design/recitation hour)

Prerequisites: INDU 251, INDU 411, and TSNG 111 or drawing competency

A study of plant design and layout. Consideration of materials-handling techniques, machinery layout and plant structures. Calculation of machine layout and study of line-balancing techniques.

INDU 492/Independent Study 1–3 cr.
(3 class hours, 1 design/recitation hour)

Prerequisites: Permission of instructor and department
For advanced students wishing to pursue a special area of interest. Topic(s) developed in consultation with a faculty adviser.

INDU 495, 496/Senior Project I, II 2 cr.
(3 class hours, 1 design/recitation hour)

Prerequisites: Senior standing and approved project proposal
Senior project focuses students' previous experience upon a specific technical project. Library research, design, cost analysis, construction, testing, and project management. Students work closely with a faculty adviser.

Mechanical Engineering Specialization Courses

MECH 251/Strength of Materials 3 cr.
(3 class hours, 1 design/recitation hour)
(spring semester)

Prerequisites: ENGR 222, Computer Programming
Topics include axial, lateral, and torsional loading of shafts and beams; statically indeterminate structures; temperature and prestrain effects; shear force and bending moment in beams; axial, shear, bearing and bending stresses; deflection of beams; buckling of columns.

MECH 263/Mechanical Engineering Laboratory I 1 cr.
(3 laboratory hours)
(spring semester)

Corequisite: MECH 251

Experiments related to strength of materials and basic stress analysis and material science. Computer data acquisition and data analysis.

MECH 311/Mechanical Design Analysis I 3 cr.
(3 class hours, 1 design/recitation hour)
(fall semester)

Prerequisite: MECH 251

Combined stresses, failure theories for static failure of ductile and brittle materials, low- and high-cycle fatigue, bolted connections with symmetric and eccentric loading.

MECH 321/Numerical Methods for Engineers 3 cr.
(3 class hours, 1 recitation hour)
(fall semester)

Prerequisites: ENGR 272, MATH 386, computer programming
Numerical solutions to linear and non-linear systems of equations; root finding methods; numerical integration; numerical methods for finding eigenvalues and eigenvectors; numerical integration of ordinary and partial differential equations.

MECH 361/Fluid Mechanics 3 cr.
(3 class hours, 1 design/recitation hour)
(spring semester)

Prerequisites: MATH 229, MATH 386, ENGR 262

Topics include hydrostatics; kinematics of fluid motion; conservation equations in integral and differential form; dimensional analysis; laminar and turbulent viscous incompressible flow; boundary layer theory; lift and drag.

MECH 363/Mechanical Engineering Laboratory II 1 cr.
(3 laboratory hours)
(spring semester)

Prerequisite: MECH 263

Corequisites: MECH 361, MECH 371

Experiments related to fluid mechanics and thermodynamics. Performance testing of an internal combustion engine.

MECH 371/Thermodynamics II 3 cr.
(3 class hours, 1 design/recitation hour)
(spring semester)

Prerequisite: ENGR 322

Topics include availability and irreversibility; power and refrigeration cycles; mixtures and solutions; chemical reactions; Maxwell relations and one-dimensional flow through nozzles and diffusers.

MECH 411/Heat Transfer 3 cr.
(3 class hours, 1 design/recitation hour)
(fall semester)

Prerequisites: ENGR 322, ENGR 342, MECH 321, MECH 361
Multi-dimensional steady state and transient conduction. Internal and external convection, blackbody and graybody thermal radiation, numerical methods for heat transfer. Design and analysis of heat exchangers.

MECH 421/Kinematics and Mechanisms 3 cr.
(3 class hours, 1 design/recitation hour)
(occasionally)

Prerequisites: ENGR 262, CMSC 215, junior status required
Analysis of displacement, velocity, and acceleration in mechanical linkages, cams, gears and mechanisms; synthesis of linkages, analytical, graphical and computer-generated solutions.

MECH 431/Mechanical Design Analysis II 3 cr.
(3 class hours, 1 design/recitation hour)
(occasionally)

Prerequisites: MECH 311, senior status required

Welded connections; mechanical springs; rolling and journal bearings; spur, helical bevel, and worm gears; clutches, brakes, and flexible mechanical elements safety; economic, reliability, and design considerations.

MECH 433/Mechanical Engineering Laboratory III 1 cr.
(3 laboratory hours)
(fall semester)

Prerequisite: MECH 363

Corequisite: MECH 411

Experiments related to heat transfer in forced and natural convection. Computer data acquisition and data analysis.

- MECH 441/Vibration Analysis** 3 cr.
(3 class hours, 1 design/recitation hour)
(occasionally)
Prerequisites: ENGR 262, MECH 321
Response of first-, second-, and multi-degree of freedom mechanical systems to periodic inputs. Energy principles to obtain natural frequencies, viscous and coulomb damping effects. Formulation of the problem of vibration of continuous bodies, non-periodic forcing effects.
- MECH 451/Heating, Ventilating, and Air Conditioning** 3 cr.
(3 class hours, 1 design/recitation hour)
(occasionally)
Prerequisites: MECH 361, MECH 371
Corequisite: MECH 411
Heating and cooling loads; principles of psychrometrics; air, electric, hydronic and steam heating systems; absorption; evaporation and vapor compression air conditioning system. Design and analysis of residential, commercial, and industrial HVAC systems.
- MECH 460/Computer-Aided Mechanical Engineering Design** 3 cr.
(3 class hours, 1 design/recitation hour)
(spring semester)
Prerequisites: MECH 311, MECH 411
Introduction to finite element analysis. Application of modern engineering tools in the design of mechanical and thermal systems.
- MECH 461/Thermal Systems Design** 3 cr.
(3 class hours, 1 design/recitation hour)
(occasionally)
Prerequisites: MECH 361, MECH 411
Workable and optimum systems, modeling of thermal systems, system simulation, and optimization.
- MECH 463/Mechanical Engineering Laboratory IV** 1 cr.
(3 laboratory hours)
(spring semester)
Prerequisite: MECH 433
Experiments related to advanced mechanical engineering topics including free and forced vibrations for first- and multi-degree of freedom systems. Measurements on elements experiencing combined stresses.
- MECH 471/Compressible Fluid Mechanics** 3 cr.
(3 class hours, 1 design/recitation hour)
(occasionally)
Prerequisites: ENGR 322, MECH 361
Study of physical acoustics, one-dimensional compressible flow, normal and oblique shock waves. Design of ducts and nozzles for compressible flow.
- MECH 481/Advanced Strength of Materials** 3 cr.
(3 class hours, 1 recitation hour)
(occasionally)
Prerequisite: MECH 311
Beams on elastic foundations, rotating discs, membrane stresses in shells, Castigliano's principles, torsional bucking of beams and shafts.
- MECH 492/Independent Study** 1–3 cr.
(occasionally)
Prerequisites: Permission of instructor, senior status required
For students wishing to study an advanced area of interest. Topic(s) developed in consultation with a faculty member.
- MECH 495, 496/Senior Project I, II** 1–3 cr.
(2 recitation hours)
(every semester)
Prerequisites: Senior standing and approved project proposal
Senior project focuses students' previous experience upon a specific technical project. Library research, design, cost analysis, construction, testing, and project management. Students work closely with a faculty adviser.

Technological Studies

Faculty: Karsnitz, Chair; Edelbach, Finkral, J. Hutchinson, Weber.

TIES Magazine: R. Todd, *Publisher and Senior Research Professor*; P. Hutchinson, *Editor-in-Chief*; K. Maskell, *Editor*

We live in a technological age. Technology is the study of the human quest for solutions. The impacts of technology on the individual, society, and environment are great. Society needs professionals who understand technological forces and are prepared to help people manage those forces. Students study a variety of themes including historical development, problem-solving techniques, design, communication, systems, and impacts. Emphasis is placed on developing design problem-solving skills. Courses are conducted in one of the 10 modern laboratories housed in the School of Engineering.

Students in the Department of Technological Studies with a teacher-education specialty receive provisional certification to teach in technology education programs in New Jersey schools. Most states recognize teacher candidates from this NCATE nationally accredited program. Students graduating from the program also take positions in business and industry such as manufacturing design and prototyping, industrial sales, training and development, or become entrepreneurs. Some students choose to pursue this program to prepare for positions in higher education or government service.

Requirements for the Technology Education Major (ETTC)

Forty-six credits in technological studies (TSNG) courses, 26 credits in technology education (TCED) courses and 56 credits in general education, professional courses, and state certification.

Entrance, Retention, and Graduation 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 technology education. Minimum grades are noted in parentheses:

- Retention in the program is based on the following performance standards in these "critical content courses": TSNG 171/Introduction to Human Technological Behavior (B-); TCED 292/Introduction to Teaching Technology Education (C+).
- Transfer in the program from another program within The College is based upon the following per-

formance standards in these “foundation courses”:
 TSNG 171/Introduction to Human Technological Behavior (B-); TCED 292/Introduction to Teaching Technology Education (C+).

Technology Education Major (ETTC)

Candidates for a teacher-education certificate must have a 2.75 cumulative grade point average, meet the state hygiene/physiology 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. The teacher candidate will also have to pay a fee during his or her first year of teaching. 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.

Four-Year Suggested Sequence

Freshman Year

TSNG	100/Department Seminar	1
STEC	161/Creative Design	3
TSNG	111/Engineering Graphics	3
TSNG	171/Intro. to Human Technological Behavior	3
TSNG	181/Materials and Processes in Design	3
RHET	101/Rhetoric I	3
RHET	102/Rhetoric II	3
PSYC	101/General Psychology	3
IDSC	151/Athens to New York	3
STAT	115/Statistics I	3

Select one of the following courses:

IDSC	105B/Applying Computing to Mathematical Problem Solving (Logo)	
------	---	--

or

MATH	127/Calculus I	3
------	----------------	---

Total for year 31

Sophomore Year

TSNG	182/Advanced Materials and Processes	3
TSNG	211/Structures and Mechanisms	3
TCED	292/Intro. to Teaching TE Science	4
SOCL	101/Intro. to Sociology	3
TSNG	231/Production Systems	3
TSNG	261/Technological Design I	3
TSNG	341/Biotechnical Systems	3
IDSC	252/Society Ethics Technology Science	4

Total for year 32

Junior Year

TSNG	201/Energy Systems in Contemporary Society	3
TSNG	211/Information Technology	3
TSNG	331/Control Systems	3
HLED	160/Health/Wellness Issues	3
RDLA	328/Teaching Reading Group B Elective	2

TSNG	351/Computer Systems	3
TSNG	361/Technological Design II	3
TCED	392/Junior Professional Exp.	3
TCED	479/Advanced Writing	3
TSNG	Technology Elective	3
	Group B Elective	3
Total for year		35

Senior Year

TCED	398/Content and Methods	4
TCED	490/Student Teaching	9
TCED	498/Seminar	2
TSNG	480/Senior Project	3
STEC	374/Technological Literacy	3
PSYCH	224/Adolescent Psychology	3
	Group B Elective	3
	Approved Elective	3
Total for year		30

Elementary Education M/S/T (ELST) Early Childhood Education M/S/T (ECST) Deaf and Hard of Hearing M/S/T (DHST) with a Technology Specialization

This interdisciplinary major integrates formal study in mathematics, biology, chemistry, physics, and technology. Students electing a technology specialization will complete 42 credits of “core” requirements including Calculus (MATH 127), Statistics (STAT 115), Principles of Biology (BIOL 181–182), Principles of Chemistry (CHEM 101–102), College Physics (PHYS 191–192), Introduction to Human Technological Behavior (TSNG 171), Principles of Structures and Mechanisms (TSNG 211), and an M/S/T-approved elective. The technology specialization consists of a minimum of 21 credits including the core technology courses, TSNG 201/Energy Systems and TSNG 261/Technological Design I, and three technology elective courses at the 300 level or higher.

Technology Minor

The minor consists of 21 credits:

TSNG	171/Introduction to Technological Behavior	3
TSNG	201/Energy Systems in Contemporary Society	3
TSNG	211/Principles of Structures and Mechanisms	3
TSNG	261/Technological Design I	3
	Technology Options (approved by the chair)	9

At least two of the courses making up this minor must be 300 level or higher. No more than three courses can be transferred into the minor.

TSNG 111/Engineering Graphics 3 cr.

(2 class hours, 3 lab hours)
 (annually—spring)

Prerequisite: STEC 161

Engineering drawing as a language and a tool of industry. Freehand drawing, orthographic projection and basic descriptive geometry, axonometric drawings, developments, and intersections. Basic dimensioning and reproduction of working drawings. Introduction to CAD.

- TSNG 171/Introduction to Human Technological Behavior** 3 cr.
(2 class hours, 3 lab hours)
(annually—fall)
An introduction to the study of how humans shape and modify their world to satisfy basic physiological needs as well as higher-level needs and wants. Students will study how the use of knowledge, tools and materials, and human-developed systems of technology has brought both benefit and risk to ourselves and our world. A design approach will be employed to provide an overview of basic technological knowledge, processes, and artifacts, including structures, mechanisms, and control.
- TSNG 181/Materials and Processes in Design** 3 cr.
(2 class hours, 3 lab hours)
(annually—spring)
Prerequisite: TSNG 171
An introduction to materials, their characteristics, and the common practices used to change their form and/or properties in order to expand their usefulness in meeting human needs and wants. Development of the ability to understand materials processing and the use of materials-processing tools and machines. The importance of safety and its relationship to materials processing will be stressed.
- TSNG 182/Advanced Materials and Processes** 3 cr.
(2 class hours, 3 lab hours)
(annually—fall)
Prerequisite: TSNG 181
An in-depth experience with materials and advanced techniques used to process them. Includes testing techniques for determining material properties, processing of natural and synthetic materials, and an analysis of past, present, and future material resources. A research-based activity will document contemporary developments in materials, science, and appropriate applications.
- TSNG 201/Energy Systems in Contemporary Society** 3 cr.
(2 class hours, 3 lab hours)
(annually—fall)
The study of energy technologies in contemporary society with emphasis on the resources, processes, conversion systems, use patterns, and future reserves. Explores the social, economic, and political implications as well as environmental consequences of particular energy options.
- TSNG 211/Principles of Structures and Mechanisms** 3 cr.
(2 class hours, 3 lab hours)
(annually—fall)
Prerequisite: TSNG 171
This course is intended to develop knowledge and capability related to two fundamental building blocks of our technological world. Students will study structural and mechanical systems, underlying scientific principles, applications, and techniques and skills used in the design and development of these systems. Emphasis on knowledge of how these systems impact society, and skills to solve new problems with structural and mechanical systems.
- TSNG 221/Information Technology** 3 cr.
(2 class hours, 3 lab hours)
(annually—fall)
A study of the systems used to encode, transmit, receive, decode, and store information. The study will include significant world communication endeavors, resources, and impacts of contemporary communication practices on this and other cultures. Major emphasis is on the mass print and mass electronic systems.
- TSNG 231/Production Systems** 3 cr.
(2 class hours, 3 lab hours)
(annually—spring)
Prerequisite: TSNG 182
A study of the structure, function, and impacts of producing artifacts, systems, and environments. Includes world manufacturing endeavors, resources, and the social and economic impacts of manufacturing on a global scale.
- TSNG 261/Technological Design I** 3 cr.
(2 class hours, 3 lab hours)
(annually—spring)
Prerequisites: TSNG 171, STEC 161
This course is intended to promote the competencies, skills, and sensibilities needed for the successful development and realization of contemporary commercial products. A design/problem-solving model will include elements of design and appearance, ergonomics, idea modeling, research, evaluation and management of resources, material selection, and processing, construction, and testing. Emphasis on documentation of design work, appreciation of stylistic traditions, and development of aesthetic sensibilities in design and realization.
- TSNG 290/History of Technological Development** 3 cr.
(3 class hours)
(occasionally)
A course exploring and comparing technological development from early civilization to the present and beyond. Emphasizes the technology humans have developed to satisfy basic needs and the effect of this technology on societal institutions. Places technological change within the context of political, cultural, and economic developments.
- TSNG 331/Control Systems** 3 cr.
(2 class hours, 3 lab hours)
(annually—fall)
Prerequisites: TSNG 171, TSNG 211
Study of electronic, fluid, and electro-mechanical systems, including sensors, control and output devices, and impacts of these systems on contemporary society. Introduction to control logic, switching, timing and other control devices and systems. Analysis of circuits and use of instrumentation.
- TSNG 341/Biotechnical Systems** 3 cr.
(2 class hours, 3 lab hours)
(annually—spring)
Prerequisite: TSNG 171
A study of the techniques, processes, and consequences of human manipulation of natural systems. Includes topics such as agriculture, food production, waste disposal, bio-energy, medical applications, and genetic manipulation. Students will study significant world bio-technology endeavors, the necessary resources, and the social and ethical impacts of biotechnology on our culture and other cultures around the world. Team taught with faculty from the Department of Biology.
- TSNG 351/Computer Systems** 3 cr.
(2 class hours, 3 lab hours)
(annually—spring)
Prerequisites: TSNG 171, TSNG 211, TSNG 331
Since the computer is considered an essential technological system, this course will introduce the fundamentals of computing through an integrated approach of programming

through lessons and activities targeting the control of computer outputs and inputs. Such outputs and inputs include the control and sensing of motors, steppers, solenoids, temperature, light, movement, and other physical characteristics. Laboratory activities are included.

TSNG 361/Technological Design II 3 cr.
(2 class hours, 3 lab hours)
(annually—spring)
Prerequisites: STEC 161, TSNG 171, TSNG 261
An advanced course in design/problem solving. Emphasis on research techniques, product development including human factor engineering and material specification, and advanced testing and evaluation. Case studies used to understand trade-offs and risks to the individual, society, and the environment associated with selected design solutions. Uses a thematic approach to selecting a problem.

TSNG 400/Problems in Construction 3 cr.
(2 class hours, 3 lab hours)
(occasionally)
Prerequisites: TSNG 211, selection must be approved by faculty adviser
Research-oriented course in problem solving and development of educational media relating to residential construction. This course involves individualized selection and completion of a project by the student while using the faculty member as a resource person.

TSNG 410/Problems in Communications 3 cr.
(2 class hours, 3 lab hours)
(occasionally)
Prerequisites: TSNG 221, selection must be approved by faculty adviser
Research-oriented course in problem solving in the field of communications. An individualized project developed through student initiative in consultation with a faculty member as an application, or an extension of material offered through formal courses in the communications sequence.

TSNG 430/Problems in Manufacturing 3 cr.
(2 class hours, 3 lab hours)
(occasionally)
Prerequisites: TSNG 231, selection must be approved by faculty adviser
A research and development-oriented advanced course in problem solving in the area of manufacturing. To evolve around an individualized project initiated by a student or faculty member to extend the knowledge and skill of the student relative to problems unique to manufacturing technology.

TSNG 444/Problems in Transportation 3 cr.
(2 class hours, 3 lab hours)
(occasionally)
Prerequisites: TSNG 201, selection must be approved by faculty adviser
A research-oriented course in problem solving in the field of power, energy, and transportation. An individualized project developed through student initiative in consultation with a faculty member from the area of power, energy, and transportation. The course will provide an extension to or an application of materials offered through transportation technology.

TSNG 466/Workshop in Technological Studies 1–6 cr.
(annually)
Prerequisites: Recommendation of faculty adviser, approval of department chair
Advanced course dealing with topics in technological studies.

TSNG 480/Senior Design Project 3 cr.
(6 lab hours)
(annually—spring)
Prerequisites: STEC 479; approved senior project proposal
Implementation of the research proposal developed in the advanced writing course. Students will design, model, test, and evaluate the proposed solution(s) to the identified problem. A written report summarizing the results of the study will be completed and submitted along with associated models and/or media.

TSNG 497/Independent Study in Technological Studies 1–6 cr.
(every semester)
Prerequisites: Permission of instructor and dean of School of Engineering
For advanced students wishing to pursue a special area of interest. Topic developed in consultation with a faculty adviser.

TCED 292/Introduction to Teaching Technology Education 3 cr.
(1 class hour, 3 lab hours)
(annually—fall)
A professional field-based experience to give an early introduction to teaching. This introduction will include observations of classroom activities, teachers, school administrative functions, and visits to various types of schools. Membership in ITEA and TEANJ is required.

TCED 392/Junior Professional Experience in Technology Education 3 cr.
(1 class hour, 3 lab hours)
(annually—spring)
Prerequisites: TCED 292, junior status, 2.5 GPA–2.75 major
Observation and limited participation as teacher aide in local public school technology education programs. Emphasis on systematic observation of teaching, planning for teaching, modes of instruction, teacher-pupil interaction analysis and lab planning, management, and controls. Field trips may be required at student expense. Continued membership in ITEA and TEANJ is required.

TCED 398/Content and Methods in Technology Education 4 cr.
(4 class hours)
(annually—fall)
Prerequisite: TCED 392
General overview of curriculum and methodology in technology education. Emphasis on development of instructional programs and materials, methodology, evaluation and facilities organization, and management in technology education. Also includes Red Cross First Aid course. Continued membership in ITEA and TEANJ is required.

TCED 466/Workshop in Technology Education 1–6 cr.
(annually)
Prerequisites: Recommendation of faculty adviser, approval of department chair
Advanced course dealing with topics in technology education.

TCED 490/Student Teaching in Technology Education 10 cr.

(16 weeks)

(annually—fall)

Prerequisites: TCED 392, 2.5 GPA–2.75 major

Student teaching during the senior year under direct supervision of public or private school teachers and a college supervisor. Experience includes observation, participation, and responsible teaching within the school along with familiarization with both the school management system and community makeup.

TCED 497/Independent Study in Technology Education 1–6 cr.

(every semester)

Prerequisites: Permission of instructor and dean of School of Engineering

For advanced students wishing to pursue a special area of interest. Topic developed in consultation with a faculty adviser.

TCED 498/Seminar in Technology Education 2 cr.

(2 class hours)

(annually—fall)

Corequisite: TCED 490

Planning for and analysis of student teacher's role in school and community. Assistance in preparing for postgraduate activities. Individual and group assignments to strengthen student teacher's preparation. Completion no earlier than successful completion of student teaching. Continued membership in ITEA and TEANJ is required.

inquiry, history, principles and processes of technology including engineering, and the impact of technological activity on the individual, society, and the environment.

STEC 479/Advanced Writing in Technology Education 3 cr.

(3 class hours)

(annually—spring)

Development of a written research proposal dealing with a contemporary technological system or problem. Written proposal to include statement of the problem, literature review via library/computer search, procedures to be followed in the study, timeline, and evaluation plan. Completed proposal to be reviewed and approved for implementation in the senior project course, via a faculty evaluation committee.

Other Offerings from the School of Engineering**STEC 161/Creative Design** 3 cr.

(2 class hours, 3 lab hours)

(every semester)

Perspectives on the World: Fine and Performing Arts
Design elements and principles as related to consumer goods. Cultivation of respect for design as a creative and pleasing solution to problems involving industrial tools, materials, and processes. Available to students in any curriculum.

STEC 215/Computer-Aided Drafting 3 cr.

(2 class hours, 3 lab hours)

(occasionally)

An introduction to the utilization of computer technology for drafting; to create or modify engineering and architectural designs in the production of a product. The course is laboratory-oriented covering topics such as sketching, dimensioning, hatching, isometric drawings, basic drawing entities, layering, digitizing, blocking, and plotting.

STEC 374/Technological Literacy 3 cr.

(2 class hours, 3 lab hours)

(annually—spring)

Prerequisites: TSNG 171, TSNG 211

An introduction to research and contemporary issues concerning the national focus on technological literacy. The course will deal specifically with concepts of design-based