

## Mechanical Engineering

*Faculty:* Paliwal, Chair, Facas, Grega, Sepahpour, Shih, Wang, Yan

The Department of Mechanical Engineering offers an academic program leading to a Bachelor of Science in Mechanical Engineering. The Mechanical Engineering program is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

This program encompasses course work in two areas of study: energy, which includes courses in thermodynamics, fluid mechanics, and heat transfer; and engineering design, with courses in strength of materials and mechanical design. The mechanical engineering degree allows for additional courses in a variety of specialized areas.

Encompassing the broadest of all engineering disciplines, the mechanical engineering program teaches students how to apply the principles of mechanics and energy to design anything from automobile engines to rocket engines and nuclear reactors. Mechanical engineers design and operate power plants and are concerned with the conversion of one form of energy to another. They also design heating, ventilating, and air conditioning systems to provide controlled conditions of temperature and humidity in homes, offices, commercial buildings, and industrial plants. Besides developing equipment and systems for refrigeration of foods and the operation of cold storage facilities, these engineers also are involved with the production of energy from alternative sources such as solar, geothermal, and wind.

### Program Educational Objectives

The mechanical engineering program has established the following educational objectives. These objectives outline what TCNJ mechanical 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 practice of engineering and related fields;
- To succeed 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 enhance career skills through life-long learning and be on the way towards achieving professional licensure.

### Mechanical Engineering Program Student Outcomes

The student outcomes listed below are expected of all graduates of the mechanical engineering program. These outcomes outline what TCNJ mechanical engineering 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 School of Engineering educational objectives.

Mechanical engineering 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.
8. an ability to apply advanced mathematics through multivariate calculus, differential equations, statistics, linear algebra, and numerical methods

### **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-); MAT127 (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 Mechanical Engineering program from another program within the College is based upon the following performance standard in these “foundation courses”: PHY 201 (C); MAT127 (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 Mechanical Engineering

### Freshman Year

#### Fall

ECO	101/Principles of Microeconomics	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

\* By advisement only.

#### Spring

CSC	215/Computer Science I	1 course unit
	<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)
CHE	201/General Chemistry I	1 course unit

### Sophomore Year

#### Fall

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
	Liberal learning elective	1 course unit

#### Spring

ENG	152/Engineering Material Science	1 course unit
ENG	262/Dynamics	1 course unit
MAT	229/Multivariable Calculus	1 course unit
MEC	251/Strength of Materials	1 course unit
MEC	263/Mechanical Engineering Laboratory I	.5 course unit
IDS	252/Society, Ethics, and Technology	1 course unit

**Junior Year****Fall**

ENG	093/Engineering Seminar III	0 course unit
ENG	322/Thermodynamics	1 course unit
ENG	342/Advanced Engineering Mathematics II	1 course unit
MEC	311/Mechanical Design Analysis I	1 course unit
MEC	321/Numerical Analysis	1 course unit
	Liberal Learning Elective*	1 course unit

\* By advisement only.

**Spring**

ENG	094/Engineering Seminar IV	0 course unit
ENG	372/Engineering Economy	1 course unit
MEC	361/Fluid Mechanics	1 course unit
MEC	363/Mechanical Engineering Laboratory II	.5 course unit
MEC	371/Thermodynamics II	1 course unit
	Mechanical Engineering 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
MEC	411/Heat Transfer	1 course unit
MEC	433/Mechanical Engineering Laboratory III	.5 course unit
MEC	460/Finite Elements in Mechanical Design	1 course unit
MEC	495/Senior Project I	0 course unit
	Mechanical Engineering Elective*	1 course unit

**Spring**

ENG	098/Fundamentals of Engineering Review	0 course unit
ENG	312/Digital Circuits and Microprocessors	1 course unit
MEC	463/Mechanical Engineering Laboratory IV	.5 course unit
MEC	496/Senior Project II	1 course unit
	Mechanical Engineering Elective*	1 course unit
	Liberal Learning Elective*	1 course unit

**Total course units**

**39 course units**

\* By advisement only.

**Mechanical Engineering Electives**

(Students must take at least one course from **Group A** and **Group B**).

GROUP A - Mechanical Design

MEC 343/Biomechanics

MEC 421/Kinematics and Mechanisms

MEC 423/Introduction to Biomaterials

MEC 431/Mechanical Design Analysis II  
 MEC 481/Advanced Strength of Materials

**GROUP B - Thermal Systems**

MEC 451/Heating, Ventilating and Air Conditioning  
 MEC 461/Thermal Systems Design  
 MEC 465/Aerodynamics  
 MEC 471/Compressible Fluid Mechanics  
 MEC470\*\*\* Special Topics in Engineering

**GROUP C - Dynamic Systems and Others**

MEC 381/Introduction to Mechatronics  
 MEC 441/Vibration Analysis  
 MEC 453/Digital Control Systems  
 MEC 473/Bioinstrumentation  
 MEC 483/Robotics  
 MEC 492/Independent Study  
 ENG 412/Process and Quality Control  
 ENG 470 Special Topics in Engineering

**Minor in Mechanical Engineering**

**Option A—Mechanical Design**

ENG 222/Statics	1 course unit
ENG 262/Dynamics	1 course unit
MEC 251/Strength of Materials	1 course unit
MEC 311/Mechanical Design I	1 course unit
Mechanical Engineering Elective*	1 course unit

**Total course units**

**5\*\* course units**

\* Mechanical engineering elective must be chosen from the following: MEC 343, MEC 421, MEC 431, MEC 481.

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

\*\*\* MEC470 may qualify for a Group A or a Group B elective, depending upon the topic.

**Minor in Mechanical Engineering**

**Option B—Thermal Systems**

ENG 222/Statics	1 course unit
ENG 322/Thermodynamics	1 course unit
MEC 361/Fluid Mechanics	1 course unit
MEC 411/Heat Transfer	1 course unit
Mechanical Engineering Elective*	1 course unit

**Total course units**

**5\*\* course units**

\* Mechanical engineering elective must be chosen from the following: MEC 371, MEC 451, MEC 461, MEC 471.

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