

# Engineering

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<http://engineering.temple.edu/additional-programs/general-engineering>

## Engineering Program

### Goals, Objectives & Design Integration

The mission of the General Engineering Program at Temple University is to provide an excellent educational experience for its students. This experience includes an emphasis on the technical, communication, teamwork and life-long learning skills that graduate engineers need to succeed, in both the workplace and society in general. The General Engineering Program is structured to prepare the graduate for the practice of engineering and graduate school or professional programs in business, law and medicine. The curriculum emphasizes a rigorous treatment of the mathematical and scientific approach to the solution of engineering problems. The program has design across the curriculum and is capped with an integrated design experience in the form of a senior project.

The General Engineering Program shall produce graduates who:

- have the theoretical and practical ability to research, analyze, design and evaluate engineering systems for modern practice and/or graduate and professional programs;
- can communicate effectively in oral, written and electronic media and have the necessary teamwork and leadership skills to work and participate effectively in a team environment; and
- are committed to life-long learning and continuous improvement and who can contribute to the economic, technical, social and educational development of the Commonwealth of Pennsylvania, the country and the world.

The Bachelor of Science in Engineering may be conferred upon a student upon the satisfactory completion of a minimum of 124 semester hours of credit.

## Summary of Requirements

### University Requirements

All new students are required to complete the university's General Education (GenEd (<http://bulletin.temple.edu/undergraduate/general-education>)) curriculum.

All Temple students must take a minimum of two writing-intensive courses as part of the major. The specific writing-intensive courses required for this major are ENGR 2196, ENGR 4196 and ENGR 4296.

### Department and Major Requirements

#### Foundation Science & Math Courses

MATH 1041	Calculus I	4
MATH 1042	Calculus II	4
MATH 2043	Calculus III	4
MATH 3041	Differential Equations I	3
Select one of the following:		6-7

ENGR 2011 & ECE 3522	Engineering Analysis & Applications and Stochastic Processes in Signals and Systems	
STAT 2103 & ENGR 2011	Statistical Business Analytics and Engineering Analysis & Applications	
PHYS 1061	Elementary Classical Physics I	4
PHYS 1062	Elementary Classical Physics II	4
CHEM 1035	Chemistry for Engineers	3
CHEM 1033	General Chemistry Laboratory I	1

#### Required Communications, Humanities & Social Science

Select one of the following:		4
ENG 0802	Analytical Reading and Writing	
ENG 0812	Analytical Reading and Writing: ESL	
ENG 0902	Honors Literature/Reading/Writing	

GenEd Electives - Humanities and Social Science Various (21 hours minimum) 21

#### Required Engineering Courses (common)

ENGR 2196	Technical Communication (WI)	3
ENGR 4169	Engineering Seminar	1
ENGR 4196	Senior Design Project I (WI) <sup>1</sup>	1
ENGR 4296	Senior Design Project II (WI) <sup>1</sup>	3

#### Study Plan

Study Plan courses (total credits vary by plan; minimum 45 hours) 45

#### Business Electives

Select two of the following:		6
ACCT 2101	Financial Accounting	
HRM 1101	Leadership and Organizational Management	
MKTG 2101	Marketing Management	
ECON 1101	Macroeconomic Principles	
ECON 1102	Microeconomic Principles	

#### Additional Electives

Engineering/Science Elective		4
Free Elective		3

Total Credit Hours 124-125

<sup>1</sup> Senior Design topic must be approved by the chair of the Department of Civil & Environmental Engineering.

## Study Plan Course Lists

### Engineering Fundamentals Study Plan

ENGR 1101	Introduction to Engineering & Engineering Technology	3
ENGR 1117	Engineering Graphics	2
ECE 2112	Electrical Devices & Systems I	3
ECE 2113	Electrical Devices & Systems I Lab	1
ENGR 2331	Engineering Statics	3
ENGR 2332	Engineering Dynamics	3
ENGR 2333	Mechanics of Solids	3
MEE 2305	Measurements & Dynamics Laboratory	1
ENGR 3096	Economic Analysis	3
ENGR 3496	Materials Science for Engineers	3
MEE 3305	Materials Laboratory	1
ENGR 3553	Mechanics of Fluids	3

MEE 3506	Fluids and Energy Laboratory	1
ENGR 3571	Classical and Statistical Thermodynamics	3
Engineering Elective 1		3
Engineering Elective 2		3
Engineering Elective 3		3
Engineering Elective 4		3
Total Credit Hours		45

## Energy and Power Study Plan

ENGR 1101	Introduction to Engineering & Engineering Technology	3
ENGR 1117	Engineering Graphics	2
ENGR 2331	Engineering Statics	3
ENGR 2332	Engineering Dynamics	3
ENGR 3571	Classical and Statistical Thermodynamics	3
MEE 4576	Photovoltaic System Design for Engineers	3
MEE 4575	Renewable and Alternative Energy	3
ECE 2112	Electrical Devices & Systems I	3
ECE 2113	Electrical Devices & Systems I Lab	1
ECE 3712	Introduction to Electromagnetic Fields and Waves	3
ECE 3732	Electromechanical Energy Systems	3
ECE 4712	Modern Power Engineering and Electronics	3
Engineering Elective 1		3
Engineering Elective 2		3
Engineering Elective 3		3
Total Credit Hours		42

## Electromechanical Study Plan

ENGR 1101	Introduction to Engineering & Engineering Technology	3
ENGR 1117	Engineering Graphics	2
ENGR 2331	Engineering Statics	3
ENGR 2332	Engineering Dynamics	3
ENGR 2333	Mechanics of Solids	3
MEE 3301	Machine Theory and Design	3
ECE 2112	Electrical Devices & Systems I	3
ECE 2113	Electrical Devices & Systems I Lab	1
ECE 2612	Digital Circuit Design	3
ECE 2613	Digital Circuit Design Laboratory	1
ECE 3612	Microprocessor Systems	3
ECE 3613	Microprocessor Systems Laboratory	1
ECE 3712	Introduction to Electromagnetic Fields and Waves	3
ECE 3732	Electromechanical Energy Systems	3
CIS 1057	Computer Programming in C	4
Engineering Elective 1		3
Engineering Elective 2		3
Total Credit Hours		45

## Electro-optical Study Plan

ENGR 1101	Introduction to Engineering & Engineering Technology	3
ECE 2112	Electrical Devices & Systems I	3

ECE 2113	Electrical Devices & Systems I Lab	1
ECE 2612	Digital Circuit Design	3
ECE 2613	Digital Circuit Design Laboratory	1
ECE 3512	Signals: Continuous and Discrete	4
ECE 3712	Introduction to Electromagnetic Fields and Waves	3
ECE 3722	Electromagnetic Wave Propagation	3
ECE 3723	Electromagnetic Wave Propagation Laboratory	1
ECE 4512	Digital Communication Systems	3
ECE 4513	Digital Communication Systems Laboratory	1
CIS 1057	Computer Programming in C	4
Engineering Elective 1		3
Engineering Elective 2		3
Engineering Elective 3		3
PHYS 2796	Introduction to Modern Physics	4
PHYS 4302	Optics	3
Total Credit Hours		46

## Hardware and Software Study Plan

ENGR 1101	Introduction to Engineering & Engineering Technology	3
ECE 2112	Electrical Devices & Systems I	3
ECE 2113	Electrical Devices & Systems I Lab	1
ECE 2612	Digital Circuit Design	3
ECE 2613	Digital Circuit Design Laboratory	1
ECE 3612	Microprocessor Systems	3
ECE 3613	Microprocessor Systems Laboratory	1
ECE 3622	Embedded System Design	3
ECE 3623	Embedded System Design Laboratory	1
ECE 4532	Data and Computer Communication	3
ECE 4612	Advanced Processor Systems	3
CIS 1057	Computer Programming in C	4
CIS 1068	Program Design and Abstraction	4
CIS 2168	Data Structures	4
CIS 3207	Introduction to Systems Programming and Operating Systems	4
Engineering Elective 1		3
Engineering Elective 2		3
Total Credit Hours		47

## Suggested Academic Plans

### Bachelor of Science in Engineering (B.S.E.) - Full Time (Day) Engineering Fundamental Basic Study Plan

### Requirements for New Students starting in the 2014-2015 Academic Year

Year 1		Credit Hours
Fall		
ENGR 1101	Introduction to Engineering & Engineering Technology	3

MATH 1041	Calculus I	4	<b>Year 3</b>		
CHEM 1035	Chemistry for Engineers	3	<b>Fall</b>	ENGR 3496	Materials Science for Engineers [WI] 3
CHEM 1033	General Chemistry Laboratory I	1		ENGR 3571	Classical and Statistical Thermodynamics 3
ENG 0802, 0812, or 0902	Analytical Reading and Writing [GW]	4		STAT 2103	Statistical Business Analytics 4
	<b>Term Credit Hours</b>	<b>15</b>		MEE 3305	Materials Laboratory 1
<b>Spring</b>				Business Elective	3
MATH 1042	Calculus II	4		GenEd Breadth Course	3
PHYS 1061	Elementary Classical Physics I	4			<b>Term Credit Hours</b> 17
ENGR 1117	Engineering Graphics	2	<b>Spring</b>		
GenEd Breadth Course		3		ENGR 3553	Mechanics of Fluids 3
	<b>Term Credit Hours</b>	<b>13</b>		MEE 3506	Fluids and Energy Laboratory 1
<b>Year 2</b>				ENGR 2196	Technical Communication [WI] 3
<b>Fall</b>					
MATH 2043	Calculus III	4		ENGR 4169	Engineering Seminar 1
PHYS 1062	Elementary Classical Physics II	4		Engineering Elective 1	3
ENGR 2331	Engineering Statics	3		GenEd Breadth Course	3
ENGR 2011	Engineering Analysis & Applications	3			<b>Term Credit Hours</b> 14
IH 0851 or 0951	Mosaic: Humanities Seminar I [GY]	3	<b>Year 4</b>		
	<b>Term Credit Hours</b>	<b>17</b>	<b>Fall</b>	ENGR 3096	Economic Analysis [WI] 3
<b>Spring</b>				ENGR 4196	Senior Design Project I [WI] 1
MATH 3041	Differential Equations I	3		Engineering Elective 2	4
ECE 2112	Electrical Devices & Systems I	3		Engineering Elective 3	4
ECE 2113	Electrical Devices & Systems I Lab	1		GenEd Breadth Course	3
ENGR 2332	Engineering Dynamics	3	<b>Spring</b>		<b>Term Credit Hours</b> 15
ENGR 2333	Mechanics of Solids	3		ENGR 4296	Senior Design Project II [WI] 3
IH 0852 or 0952	Mosaic: Humanities Seminar II [GZ]	3		GenEd Breadth Course	4
MEE 2305	Measurements & Dynamics Laboratory	1		Buisness Elective	3
	<b>Term Credit Hours</b>	<b>17</b>		Engineering Elective 4	3
				Free Elective	3
					<b>Term Credit Hours</b> 16
					Total Credit Hours: 124

## Bachelor of Science in Engineering (B.S.E.) - Part-Time (Night) Engineering Fundamentals Basic Study Plan

### Requirements for New Students starting in the 2014-2015 Academic Year

<b>Year 1</b>			ENGR 2331	Engineering Statics	3
<b>Fall</b>			CHEM 1035	Chemistry for Engineers	3
ENGR 1101	Introduction to Engineering & Engineering Technology	Credit Hours 3		General Chemistry Laboratory I	1
			<b>Spring</b>		
			ENGR 2333	Mechanics of Solids	3
			ENGR 2011	Engineering Analysis & Applications	3
MATH 1041	Calculus I	4			
	<b>Term Credit Hours</b>	<b>7</b>		<b>Term Credit Hours</b>	<b>6</b>
<b>Spring</b>			<b>Summer</b>		
MATH 1042	Calculus II	4	IH 0852 or 0952	Mosaic: Humanities Seminar II [GZ]	3
ENGR 1117	Engineering Graphics	2			
	<b>Term Credit Hours</b>	<b>6</b>	GenEd Breadth Course		3
				<b>Term Credit Hours</b>	<b>6</b>
<b>Summer</b>					
ENG 0802, 0812, or 0902	Analytical Reading and Writing [GW]	4			
			<b>Year 4</b>		
			<b>Fall</b>		
GenEd Breadth Course		3	ENGR 3096	Economic Analysis [WJ]	3
	<b>Term Credit Hours</b>	<b>7</b>			
			ENGR 3496	Materials Science for Engineers [WJ]	3
<b>Year 2</b>				<b>Term Credit Hours</b>	<b>6</b>
<b>Fall</b>					
MATH 2043	Calculus III	4			
PHYS 1061	Elementary Classical Physics I	4			
	<b>Term Credit Hours</b>	<b>8</b>	<b>Spring</b>		
			ENGR 2332	Engineering Dynamics	3
			ENGR 3571	Classical and Statistical Thermodynamics	3
<b>Spring</b>				<b>Term Credit Hours</b>	<b>6</b>
MATH 3041	Differential Equations I	3			
PHYS 1062	Elementary Classical Physics II	4			
	<b>Term Credit Hours</b>	<b>7</b>	<b>Summer</b>		
			MEE 2305	Measurements & Dynamics Laboratory	1
<b>Summer</b>					
STAT 2103	Statistical Business Analytics	4	MEE 3305	Materials Laboratory	1
			GenEd Breadth Course		3
IH 0851 or 0951	Mosaic: Humanities Seminar I [GY]	3		<b>Term Credit Hours</b>	<b>5</b>
	<b>Term Credit Hours</b>	<b>7</b>	<b>Year 5</b>		
<b>Year 3</b>			<b>Fall</b>		
<b>Fall</b>			ECE 2112	Electrical Devices & Systems I	3

ECE 2113	Electrical Devices & Systems I Lab	1
Free Elective		3
	<b>Term Credit Hours</b>	7
<b>Spring</b>		
ENGR 3553	Mechanics of Fluids	3
Engineering Elective 1		3
	<b>Term Credit Hours</b>	6
<b>Summer</b>		
MEE 3506	Fluids and Energy Laboratory	1
GenEd Breadth Course		3
	<b>Term Credit Hours</b>	4
<b>Year 6</b>		
<b>Fall</b>		
ENGR 4169	Engineering Seminar	1
ENGR 2196	Technical Communication [WI]	3
	<b>Term Credit Hours</b>	4
<b>Spring</b>		
ENGR 4196	Senior Design Project I [WI]	1
Engineering Elective 2		4
	<b>Term Credit Hours</b>	5
<b>Summer</b>		
GenEd Breadth Course		4
Engineering Elective 3		4
	<b>Term Credit Hours</b>	8
<b>Year 7</b>		
<b>Fall</b>		
ENGR 4296	Senior Design Project II [WI]	3
Business Elective		3
	<b>Term Credit Hours</b>	6
<b>Spring</b>		
Engineering Elective 4		3
Business Elective		3
	<b>Term Credit Hours</b>	6
Total Credit Hours:		124

## Courses

### ENGR 1101. Introduction to Engineering & Engineering Technology. 3 Credit Hours.

Provides an understanding of the study and practice associated with bioengineering, civil, electrical, mechanical engineering and technology disciplines. Understand the importance of good communications and teamwork skills in a successful engineering and technology career. Understand the basics of problem solving and design. Discipline-specific labs.

**College Restrictions:** Must be enrolled in one of the following Colleges: Engineering

**Repeatability:** This course may not be repeated for additional credits.

### ENGR 1102. Introduction to Engineering. 3 Credit Hours.

This course is designed to introduce students to the field of Engineering. An objective will be to integrate teamwork, problem solving, and verbal communication skills into design projects and homework assignments within the course in such a way that these skills become the foundation of a successful career. Early understanding of these skills will assist students throughout their undergraduate experience and beyond, Field trips to local companies will provide insight into engineering careers. The primary objective is to enhance your success as a student and as a person.

**Repeatability:** This course may not be repeated for additional credits.

### ENGR 1117. Engineering Graphics. 2 Credit Hours.

Computer-aided geometrical construction, solids modeling, charts, orthographic and isometric drawings, dimensioning, auxiliary views, sectioning, geometric tolerancing, and elementary drafting problems.

**College Restrictions:** Must be enrolled in one of the following Colleges: Engineering

**Repeatability:** This course may not be repeated for additional credits.

### ENGR 1185. Internship Experience I. 1 to 4 Credit Hour.

Work experience in industry, governmental agencies, or educational institutions is arranged through the Director of Career Services in the College of Engineering. The course is for one semester of work experience. Letter from supervisor and report by student are required.

**Class Restrictions:** May not be enrolled in one of the following: Freshman 0 to 29 Credits

**Repeatability:** This course may be repeated for additional credit.

### ENGR 1901. Honors Introduction to Engineering. 3 Credit Hours.

Provides a high level understanding of the study and practice associated with bioengineering, civil, electrical, mechanical engineering and technology disciplines. Understand the importance of good communication and teamwork skills in a very successful engineering and technology career. Understand the fundamentals of problem solving and design. Discipline-specific labs.

**College Restrictions:** Must be enrolled in one of the following Colleges: Engineering

**Cohort Restrictions:** Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR

**Course Attributes:** HO

**Repeatability:** This course may not be repeated for additional credits.

**ENGR 2011. Engineering Analysis & Applications. 3 Credit Hours.**

This course introduces engineering applications of mathematical concepts through the programming environment of Matlab. Topics covered include vectors and matrices, linear matrix equations with engineering applications, eigenvalue problem, interpolation, differentiation and integration, and optimization. Engineering applications of various concepts are emphasized.

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

MATH 1042|Minimum Grade of C-|May not be taken concurrently.

**ENGR 2181. Co-Op Work Experience I. 3 Credit Hours.**

Each is a prerequisite to the course that follows. Full time work experience in industry, governmental agencies, or educational institutions is arranged through the co-op coordinator of the College of Engineering (15 weeks, 40 hours/week). Students are considered as academically full-time during work periods.

**Class Restrictions:** May not be enrolled in one of the following:  
Freshman 0 to 29 Credits

**Repeatability:** This course may be repeated for additional credit.

**ENGR 2185. Internship Experience II. 1 to 4 Credit Hour.**

Work experience in industry, governmental agencies, or educational institutions is arranged through the Director of Career Services in the College of Engineering. The course is for one semester of work experience. Letter from supervisor and report by student are required.

**Repeatability:** This course may be repeated for additional credit.

**Pre-requisites:**

ENGR 1185|Minimum Grade of D-|May not be taken concurrently.

**ENGR 2196. Technical Communication. 3 Credit Hours.**

This course for civil, electrical, and mechanical engineering students emphasizes major principles and methods of research-based technical writing, along with related MS Office techniques for word processing and report graphics. Writing assignments provide guided individual and team practice in meeting the needs of diverse technical and nontechnical audiences while complying with complex format specifications. Many of the techniques studied will be directly applicable to the writing requirements of the Senior Design course.

**Course Attributes:** WI

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

(MATH 1042|Minimum Grade of C-|May be taken concurrently  
OR MATH 1942|Minimum Grade of C-|May be taken concurrently)  
AND (PHYS 1061|Minimum Grade of C-|May be taken concurrently  
OR PHYS 2021|Minimum Grade of C-|May be taken concurrently  
OR PHYS 2921|Minimum Grade of C-|May be taken concurrently).

**ENGR 2331. Engineering Statics. 3 Credit Hours.**

Vector mechanics of force and moment systems in two and three dimensions, freebody diagrams and the static equilibrium of structures, centroids, moments of inertia, frictional systems, shearing force, and bending moment diagrams.

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

(MATH 1042|Minimum Grade of C-|May be taken concurrently  
OR MATH 1942|Minimum Grade of C-|May be taken concurrently)  
AND (PHYS 1061|Minimum Grade of C-|May not be taken concurrently  
OR PHYS 2021|Minimum Grade of C-|May not be taken concurrently  
OR PHYS 2921|Minimum Grade of C-|May not be taken concurrently).

**ENGR 2332. Engineering Dynamics. 3 Credit Hours.**

A vector approach to the study of the rectilinear and curvilinear motion of particles and rigid bodies as described by rectangular, polar, and path coordinates and the study of the forces that produce such motion as described through the application of Newton's second law of motion, work-energy relationships, and impulse and momentum principles, including rigid body rotation and relative motion.

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

ENGR 2331|Minimum Grade of C-|May not be taken concurrently  
OR ENGR 2931|Minimum Grade of C-|May not be taken concurrently.

**ENGR 2333. Mechanics of Solids. 3 Credit Hours.**

Classical approach to axial stress and strain, torsion, bending, combined stress, biaxial stress, deflection of beams and frames, elastic strain energy, pressure vessels, column stability, and buckling.

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

ENGR 2331|Minimum Grade of C-|May not be taken concurrently  
OR ENGR 2931|Minimum Grade of C-|May not be taken concurrently.

**ENGR 2334. Engineering Statics/Dynamics. 3 Credit Hours.**

Vector mechanics of force and moment systems in two and three dimensions, free body diagrams and the static equilibrium of structures, centroids, area and mass of the rectilinear and curvilinear motion of particles as described by rectangular, polar and path coordinates and the study of the forces that produce such motion using Newton's second law of motion, work-energy relationships, and impulse-momentum techniques. An overview of rigid body rotation is presented.

**Repeatability:** This course may not be repeated for additional credits.

**ENGR 2335. Mechanics I. 3 Credit Hours.**

A vector mechanics study of STATICS: free body diagrams, equilibrium, resultant force/couple systems, reaction forces and couples on 2-D and 3-D systems, member forces in trusses; and DYNAMICS: kinematics and kinetics of particles.

**Co-requisites:**

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

(MATH 1042|Minimum Grade of C-|May be taken concurrently  
OR MATH 1942|Minimum Grade of C|May be taken concurrently  
OR MATH 1951|Minimum Grade of C|May be taken concurrently  
OR MATH 2043 to 3080| Required Courses:1|Minimum Grade of C-|May be taken concurrently  
OR MA07 Y|May not be taken concurrently)  
AND (PHYS 1061|Minimum Grade of C-|May be taken concurrently  
OR PHYS 2021|Minimum Grade of C-|May be taken concurrently  
OR PHYS 2921|Minimum Grade of C-|May be taken concurrently  
OR PHYS 1062|Minimum Grade of C-|May be taken concurrently  
OR PHYS 2022|Minimum Grade of C-|May be taken concurrently  
OR PHYS 2922|Minimum Grade of C-|May be taken concurrently  
OR PHYS 2101 to 2701| Required Courses:1|Minimum Grade of C-|May be taken concurrently  
OR PHYS 3101 to 3701| Required Courses:1|Minimum Grade of C-|May be taken concurrently  
OR PHYS 4101 to 4796| Required Courses:1|Minimum Grade of C-|May be taken concurrently).



**ENGR 2336. Mechanics II. 3 Credit Hours.**

A vector mechanics study of STATICS: centroids, moments of inertia, shearing force and bending moment diagrams, frictional systems; and DYNAMICS: the rectilinear and curvilinear motion, rigid bodies as described by rectangular, polar and path coordinates and the study of the forces that produce such motion as described through the application of Newton's second law of motion, work-energy relationships, and impulse and momentum principles, including rigid body rotation and relative motion.

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

ENGR 2335|Minimum Grade of D-|May not be taken concurrently.

**ENGR 2931. Honors Engineering Statics. 3 Credit Hours.**

Vector mechanics of force and moment systems in two and three dimensions, freebody diagrams and the static equilibrium of structures, centroids, moments of inertia, frictional systems, shearing force, and bending moment diagrams. This honors class will be held to high standards.

**College Restrictions:** Must be enrolled in one of the following Colleges: Engineering

**Cohort Restrictions:** Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR

**Course Attributes:** HO

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

(MATH 1041|Minimum Grade of C-|May not be taken concurrently)  
OR MATH 1941|Minimum Grade of C-|May not be taken concurrently)  
AND (PHYS 1061|Minimum Grade of C-|May not be taken concurrently)  
OR PHYS 2021|Minimum Grade of C-|May not be taken concurrently)  
OR PHYS 2921|Minimum Grade of C-|May not be taken concurrently).

**ENGR 2933. Honors Mechanics of Solids. 3 Credit Hours.**

Classical approach to axial stress and strain, torsion, bending, combined stress, biaxial stress, deflections of beams and frames, elastic strain energy, pressure vessels, column stability, and buckling. Very challenging honors course.

**College Restrictions:** Must be enrolled in one of the following Colleges: Engineering

**Cohort Restrictions:** Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR

**Course Attributes:** HO

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

ENGR 2931|Minimum Grade of C-|May not be taken concurrently.

**ENGR 3033. Entrepreneurial Engineering. 3 Credit Hours.**

The course is specifically designed to introduce students to the ideas and concepts of entrepreneurship; to help students recognize the entrepreneurial potential within themselves and others in their environment; link the entrepreneur's spirit with the engineer's mind and discipline; give the students the understanding of the opportunities and challenges facing any entrepreneur from the start up through running and growing a business; and create an understanding of the role of technology in developing the students' understanding of all the different opportunity paths that are available in today's economic and global environment. Students will develop an awareness of how to detect, understand, and develop product and/or service opportunities; understand and master the different business, legal, regulatory and human challenges that confront any business every day; understand the basic accounting, marketing, sales, negotiating, communication, intellectual property and analytical tools of business and how to apply them; understand how to decipher and learn from case studies; and learn the importance of and the creation of a business plan and how to use it to raise money and/or support for their business venture.

**Class Restrictions:** Must be enrolled in one of the following Classes:

Junior 60 to 89 Credits, Senior 90 to 119 Credits, Senior/Fifth Year 120+ Credits

**College Restrictions:** Must be enrolled in one of the following Colleges: Engineering

**Repeatability:** This course may not be repeated for additional credits.

**ENGR 3096. Economic Analysis. 3 Credit Hours.**

The objectives of the course are to learn about economic analysis tools and communication skills for engineers. The economics component places an emphasis on engineering problems and projects, where measures of merit such as present worth, rate of return, and benefit / cost ratio are used in problem solving. Written communication techniques, for improving the clarity of technical documents are discussed, along with systematic methods to improve oral presentation skills.

**Class Restrictions:** Must be enrolled in one of the following Classes:

Junior 60 to 89 Credits, Senior 90 to 119 Credits, Senior/Fifth Year 120+ Credits

**College Restrictions:** Must be enrolled in one of the following Colleges: Engineering

**Course Attributes:** WI

**Repeatability:** This course may not be repeated for additional credits.

**ENGR 3117. Computer-Aided Design (CAD). 3 Credit Hours.**

Introduction to Computer Aided Design (CAD) using the state of the art ANSYS finite element program. The focus is to train students to perform advanced two- and three- dimensional solid modeling/stress analysis using ANSYS finite element software for solving and designing complex mechanical structures. It is expected that before taking this course, students have fundamental understanding of statics, dynamics, and solid mechanics concepts. Design projects will be given where students will have to design, analyze, and manufacture structural designs.

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

(ENGR 1117|Minimum Grade of D-|May not be taken concurrently)  
AND (ENGR 2332|Minimum Grade of C-|May not be taken concurrently)  
AND (ENGR 2333|Minimum Grade of C-|May not be taken concurrently)  
OR ENGR 2933|Minimum Grade of C-|May not be taken concurrently)  
AND (MATH 2101|Minimum Grade of C-|May not be taken concurrently)  
OR ENGR 2011|Minimum Grade of C-|May not be taken concurrently)  
OR MEE 2011|Minimum Grade of C-|May not be taken concurrently)  
AND (MATH 3041|Minimum Grade of C-|May not be taken concurrently).

**ENGR 3181. Co-Op Work Experience II. 3 Credit Hours.**

Each is a prerequisite to the course that follows. Full time work experience in industry, governmental agencies, or educational institutions is arranged through the co-op coordinator of the College of Engineering (15 weeks, 40 hours/week). Students are considered as academically full-time during work periods.

**Repeatability:** This course may be repeated for additional credit.

**Pre-requisites:**

ENGR 2181|Minimum Grade of D-|May not be taken concurrently.

**ENGR 3185. Internship Experience III. 1 to 4 Credit Hour.**

Work experience in industry, governmental agencies, or educational institutions is arranged through the Director of Career Services in the College of Engineering. The course is for one semester of work experience. Letter from supervisor and report by student are required.

**Repeatability:** This course may be repeated for additional credit.

**Pre-requisites:**

ENGR 2185|Minimum Grade of D-|May not be taken concurrently.

**ENGR 3281. Co-op Experience I. 3 Credit Hours.**

Students will research Co-op opportunities, receive the Director's approval for the specific Co-op, set up interviews, and obtain a position and work a minimum thirty-five hours a week during the 14-week term for the three credit hours in a professional environment related to the careers they might have an interest. Students are responsible for preparing themselves for the professional experience in consultation with the Director of the Co-op program. There will be a number of sources to choose from, including approved opportunities maintained on file in the Director's office, student generated or discovered opportunities for which student must receive prior approval and opportunities with established commercial, engineering and professional organizations approved by the Director. Students may take Co-op experiences with different entities but are encouraged to repeat professional experiences with the same organization.

**Class Restrictions:** May not be enrolled in one of the following:  
Freshman 0 to 29 Credits

**Repeatability:** This course may be repeated for additional credit.

**ENGR 3334. Mechanical Systems. 3 Credit Hours.**

This course considers the fundamentals of mechanics including statics, dynamics, materials, thermodynamics and fluid mechanics and their application to systems of beams, pulleys, gear trains, levers exhibiting vibration, heat conduction, convection and expansion and fluid flow.

**Department restrictions:** Must be enrolled in one of the following  
Departments: Engineering:Elec Engineering

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

(PHYS 1062|Minimum Grade of C-|May not be taken concurrently)  
AND (MATH 2043|Minimum Grade of C-|May not be taken concurrently).

**ENGR 3381. Co-op Experience II. 3 Credit Hours.**

Students will research Co-op opportunities, receive the Director's approval for the specific Co-op, set up interviews, and obtain a position and work a minimum thirty-five hours a week during the 14-week term for the three credit hours in a professional environment related to the careers they might have an interest. Students are responsible for preparing themselves for the professional experience in consultation with the Director of the Co-op program. There will be a number of sources to choose from, including approved opportunities maintained on file in the Director's office, student generated or discovered opportunities for which student must receive prior approval and opportunities with established commercial, engineering and professional organizations approved by the Director. Students may take Co-op experiences with different entities but are encouraged to repeat professional experiences with the same organization.

**Repeatability:** This course may be repeated for additional credit.

**Pre-requisites:**

ENGR 3281|Minimum Grade of D-|May not be taken concurrently.

**ENGR 3496. Materials Science for Engineers. 3 Credit Hours.**

Atomic and molecular structures, bonding and interatomic forces, thermodynamics and kinetics of solid reactions, mechanical, electronic, and magnetic properties of solids. Design projects with written reports.

**Course Attributes:** WI

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

(PHYS 1062|Minimum Grade of C-|May not be taken concurrently  
OR PHYS 2022|Minimum Grade of C-|May not be taken concurrently  
OR PHYS 2922|Minimum Grade of C-|May not be taken concurrently)  
AND (CHEM 1031|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1951|Minimum Grade of C-|May not be taken concurrently  
OR CHEM 1035|Minimum Grade of C-|May not be taken concurrently)  
AND (ENGR 2333|Minimum Grade of C-|May be taken concurrently  
OR ENGR 2933|Minimum Grade of C-|May be taken concurrently).

**ENGR 3553. Mechanics of Fluids. 3 Credit Hours.**

General physical properties of fluids. Fluid statics and pressure measurements. Kinematics of fluid motion. Conservation laws in control volume and differential forms with applications. Bernoulli's equation and irrotation flow. Viscous flow in pipes and flow measurements. Boundary layer concepts. Numerical methods. Design project.

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

(ENGR 2332|Minimum Grade of C-|May not be taken concurrently  
OR BIOE 2312|Minimum Grade of C-|May not be taken concurrently)  
AND (ENGR 2333|Minimum Grade of C-|May not be taken concurrently  
OR ENGR 2933|Minimum Grade of C-|May not be taken concurrently  
OR BIOE 3312|Minimum Grade of C-|May not be taken concurrently)  
AND (MATH 3041|Minimum Grade of D-|May not be taken concurrently).



**ENGR 3571. Classical and Statistical Thermodynamics. 3 Credit Hours.**

The study of the concepts, theory, and application of energy and entropy from a classical and statistical viewpoint. NOTE: Special Authorization for Non-Majors. Open to all engineering majors.

**College Restrictions:** Must be enrolled in one of the following Colleges: Engineering

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

(PHYS 1062|Minimum Grade of C-|May not be taken concurrently  
OR PHYS 2022|Minimum Grade of C-|May not be taken concurrently  
OR PHYS 2922|Minimum Grade of C-|May not be taken concurrently)  
AND (MATH 1042|Minimum Grade of C-|May not be taken concurrently  
OR MATH 1942|Minimum Grade of C-|May not be taken concurrently).

**ENGR 3953. Honors Mechanics of Fluids. 3 Credit Hours.**

General physical properties of fluids. Fluid statics and pressure measurements. Kinematics of fluid motion. Conservation laws in control volume and differential forms with applications. Bernoulli's equation and irrotation flow. Viscous flow in pipes and flow measurements. Boundary layer concepts. Numerical methods. Design project. This honors course will be held to high standards.

**College Restrictions:** Must be enrolled in one of the following Colleges: Engineering

**Cohort Restrictions:** Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR

**Course Attributes:** HO

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

(MATH 3041|Minimum Grade of D-|May not be taken concurrently)  
AND (ENGR 2332|Minimum Grade of C-|May not be taken concurrently)  
AND (ENGR 2933|Minimum Grade of C-|May not be taken concurrently).

**ENGR 3982. Honors Independent Study. 1 to 4 Credit Hour.**

A challenging opportunity to either 1) study an honors course which is not offered during the semester, or 2) study specialized topics not covered in currently available honors courses. High standards are expected of the student by an honors faculty who will supervise.

**Class Restrictions:** Must be enrolled in one of the following Classes: Junior 60 to 89 Credits, Senior 90 to 119 Credits, Senior/Fifth Year 120+ Credits

**College Restrictions:** Must be enrolled in one of the following Colleges: Engineering

**Cohort Restrictions:** Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR

**Course Attributes:** HO

**Repeatability:** This course may be repeated for additional credit.

**ENGR 4040. Special Topics. 1 to 4 Credit Hour.**

A course designed to present new and emerging areas of engineering. The course may also be used to present areas not normally taught in the College. Course requirements vary with the topic and instructor. Offered as needed or as appropriate.

**Class Restrictions:** Must be enrolled in one of the following Classes: Junior 60 to 89 Credits, Senior 90 to 119 Credits, Senior/Fifth Year 120+ Credits

**College Restrictions:** Must be enrolled in one of the following Colleges: Engineering

**Repeatability:** This course may be repeated for additional credit.

**ENGR 4101. Fundamentals of Engineering (FE) Examination Review. 1 Credit Hour.**

This course will give students the practical and theoretical knowledge to help pass the FE examination. The course provides a comprehensive review of basic science and engineering, theories and applications, advanced topics in civil and mechanical engineering. Problem solving and test taking strategies will be an integral part of the course. The course will provide additional assessment for ABET.

**Repeatability:** This course may not be repeated for additional credits.

**ENGR 4116. Spacecraft Systems Engineering. 3 Credit Hours.**

This course will introduce the systems engineering concept through satellite applications. The goals of this course are to introduce: a) systems engineering concepts, b) satellite subsystems, c) astrodynamics, and d) intellectual property. Topics covered will include space environment, dynamics of spacecraft, celestial mechanics, mission analysis, attitude control, systems engineering, and patents.

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

MATH 3041|Minimum Grade of D-|May not be taken concurrently.

**ENGR 4169. Engineering Seminar. 1 Credit Hour.**

Preparation for entering the professional world of engineering. Includes job placement, professional registration, ethics, professional societies, case studies, and guest speakers.

**Class Restrictions:** Must be enrolled in one of the following Classes: Junior 60 to 89 Credits, Senior 90 to 119 Credits, Senior/Fifth Year 120+ Credits

**College Restrictions:** Must be enrolled in one of the following Colleges: Engineering

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

ENGR 2196|Minimum Grade of C-|May not be taken concurrently.

**ENGR 4181. Co-Op Work Experience III. 1 Credit Hour.**

Each is a prerequisite to the course that follows. Full time work experience in industry, governmental agencies, or educational institutions is arranged through the co-op coordinator of the College of Engineering (15 weeks, 40 hours/week). Students are considered as academically full-time during work periods.

**Repeatability:** This course may be repeated for additional credit.

**Pre-requisites:**

ENGR 3181|Minimum Grade of D-|May not be taken concurrently.

**ENGR 4182. Independent Study in Engineering. 1 to 5 Credit Hour.**

Arranged each semester, please consult with the instructor.

**Repeatability:** This course may be repeated for additional credit.

**ENGR 4185. Internship Experience IV. 1 to 4 Credit Hour.**

Work experience in industry, governmental agencies, or educational institutions is arranged through the Director of Career Services in the College of Engineering. The course is for one semester of work experience. Letter from supervisor and report by student are required.

**Repeatability:** This course may be repeated for additional credit.

**Pre-requisites:**

ENGR 3185|Minimum Grade of D-|May not be taken concurrently.

**ENGR 4196. Senior Design Project I. 1 Credit Hour.**

Team-oriented engineering system design problems of various types. Topics proposed and orally presented by students in the initial stage of the course sequence. At completion, the project is demonstrated during an oral presentation and a final written report.

**Class Restrictions:** Must be enrolled in one of the following Classes: Senior 90 to 119 Credits, Senior/Fifth Year 120+ Credits

**College Restrictions:** Must be enrolled in one of the following Colleges: Engineering

**Course Attributes:** WI

**Repeatability:** This course may not be repeated for additional credits.

**ENGR 4281. Co-Op Work Experience IV. 1 Credit Hour.**

Full time work experience in industry, governmental agencies, or educational institutions is arranged through the co-op coordinator of the College of Engineering (15 weeks, 40 hours/week). Students are considered as academically full-time during work periods.

**Repeatability:** This course may be repeated for additional credit.

**Pre-requisites:**

ENGR 4181|Minimum Grade of D-|May not be taken concurrently.

**ENGR 4296. Senior Design Project II. 3 Credit Hours.**

Team-oriented engineering system design problems of various types. Topics proposed and orally presented by students in the initial stage of the course sequence. At completion, the project is demonstrated during an oral presentation and a final written report.

**Course Attributes:** WI

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

ENGR 4196|Minimum Grade of D-|May not be taken concurrently.

**ENGR 4314. Continuum Mechanics. 3 Credit Hours.**

Tensors, Kinematics of Continuum, Stress, Integral Formulations, the Elastic Solid, and the Newtonian Fluid.

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

(MATH 3041|Minimum Grade of D-|May not be taken concurrently)

AND (ENGR 2333|Minimum Grade of C-|May not be taken concurrently

OR ENGR 2933|Minimum Grade of C-|May not be taken concurrently).

**ENGR 4334. Advanced Dynamical Systems. 3 Credit Hours.**

The objective of this course is to establish the theoretical basis for the description of regular and chaotic dynamical systems. To understand the basic ideas of dynamical systems and the nature of chaotic behavior, and to be able to apply these ideas to particular systems. To learn how to choose the appropriate modeling techniques and hypothesis to establish a mathematical model of a qualitatively described phenomenon. The discussed applications will include examples from fluid mechanics, physics and biology.

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

MATH 3041|Minimum Grade of D-|May not be taken concurrently.

**ENGR 4576. Computational Fluid Dynamics. 3 Credit Hours.**

The students will learn to analyze and computationally solve problems in Heat Transfer and Fluid Dynamics. They will learn to program fundamental problems on simple geometric entities using MATLAB as well as the use of commercially available CFD programs to tackle complex three-dimensional geometry. Additionally, students will also be introduced to various discretization techniques for solving the governing differential equations, and iterative schemes for solving algebraic equations.

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

ENGR 3553|Minimum Grade of C-|May not be taken concurrently

OR ENGR 3953|Minimum Grade of C-|May not be taken concurrently.

**ENGR 4577. Nanotechnology Solutions for a Sustainable Urban Environment. 3 Credit Hours.**

The course will introduce students to the revolutionary field of nanotechnology, where emphasis will be placed on using nanomaterials to the betterment of a sustainable urban environment. Students will be introduced to the remarkable transformation that the mechanical, optical, electrical, and thermal material properties undergo as their dimensions are reduced to the nanoscale. They will also understand the major nanomaterial fabrication techniques such as nanoscale lithography and self-assembly. In addition, students will be introduced to techniques which characterize materials on the nanoscale. The second half of the course will be devoted to applications and potential applications of nanotechnology which will advance urban sustainability. Applications in water purification, transportation, energy and biomedicine will be presented to the students through series of expert lectureships offered by Temple University faculty utilizing nanomaterials in their research laboratories. Students will also carry out laboratory modules devoted to the use of nanomaterials for these applications.

**Class Restrictions:** Must be enrolled in one of the following Classes: Junior 60 to 89 Credits, Senior 90 to 119 Credits, Senior/Fifth Year 120+ Credits

**College Restrictions:** Must be enrolled in one of the following Colleges: Engineering

**Repeatability:** This course may not be repeated for additional credits.

**ENGR 4996. Honors Senior Design Project II. 3 Credit Hours.**

Continuation of Senior Design Project I for honors teams. Students will complete a team project with an Honors Faculty mentor. Assignments will include a design review, monthly progress reports, a poster, an oral presentation and a final report. This course is writing intensive. For those on the Honors Scholar track, the final report produced in this course may be submitted as the Honors Scholar Project.

**College Restrictions:** Must be enrolled in one of the following Colleges: Engineering

**Cohort Restrictions:** Must be enrolled in one of the following Cohorts: SCHONORS, UHONORS, UHONORSTR

**Course Attributes:** HO, WI

**Repeatability:** This course may not be repeated for additional credits

**Pre-requisites:**

ENGR 4196|Minimum Grade of D-|May not be taken concurrently.