

## Articulation Agreement



### The University of Pittsburgh Swanson School of Engineering & Gettysburg College

#### *Overview of Program*

The purpose of this document is to establish an Articulation Agreement between the University of Pittsburgh, Swanson School of Engineering and Gettysburg College. Students are eligible under the guidelines of this Articulation Agreement if they have completed each of the following requirements:

- The student must have been enrolled at Gettysburg College for at least the past two years.
- The student must have received cumulative GPA of 3.0 or higher as calculated on a 4.0 scale. Students intending on applying to Bioengineering must have received a cumulative GPA of 3.5 or higher.
- The student must have received a favorable recommendation from the Articulation Agreement Program Liaison at Gettysburg College. This recommendation must be included in the student's application packet to the University of Pittsburgh's Office of Admissions and Financial Aid.
- The student must have successfully completed the specific science and math prerequisite courses for the intended major listed in the University of Pittsburgh, Swanson School of Engineering Articulation Agreement Curriculum Guide with a re-calculated GPA of 3.0 in these courses and a grade of C or better in each course.
- The student must have completed or plan to transfer back courses for the major requirement prescribed by Gettysburg College for graduation.

Admission to the University of Pittsburgh, Swanson School of Engineering at the end of the junior year is guaranteed for those students who have completed the appropriate steps outlined above.

### *Introduction*

This agreement specifies the terms by which the University of Pittsburgh and Gettysburg College agree to cooperate in facilitating the transfer of students to pursue dual baccalaureate degrees from the University of Pittsburgh, Swanson School of Engineering and Gettysburg College.

The articulation agreement program between the University of Pittsburgh and Gettysburg College will normally consist of three years of instruction at Gettysburg College followed by instruction at the University of Pittsburgh. While some students may be able to complete the prescribed engineering courses in four semesters (two years), certain engineering degree programs may necessitate attendance for additional terms to complete all degree requirements. Due to this fact, this agreement is not a 3/2 agreement.

Provided that all stipulated criteria have been met, the student will receive a Bachelor of Arts degree from Gettysburg College and a Bachelor of Science in Engineering degree from the University of Pittsburgh.

The Swanson School of Engineering offers B.S. degrees in Bioengineering, Chemical and Petroleum Engineering, Civil and Environmental Engineering, Computer Engineering, Electrical Engineering, Engineering Science, Industrial Engineering, Materials Science and Engineering, and Mechanical Engineering.

Students from Gettysburg College who will be transferring to the University of Pittsburgh as part of this agreement will also be eligible to participate in the School's other education enhancement programs including the Cooperative Education Program and the Engineering International Program. Students may also choose to pursue either a minor or certificate in another engineering or arts and sciences area. Participation in these optional programs may require additional time to graduate. Interested students should consult the University of Pittsburgh Undergraduate Bulletin for more information (<http://www.bulletins.pitt.edu/undergrad/>).

Any and all modifications of this document must occur through formal notification and revision of this agreement.

### ***Recruitment***

The availability of the articulation agreement program between the University of Pittsburgh, Swanson School of Engineering and Gettysburg College will be included in literature developed and distributed by both institutions. Gettysburg College is encouraged to develop brochures and other suitable material outlining the course content and the features of this program. Such information concerning the program may be distributed through Gettysburg College's Office of Admissions. Gettysburg College will be primarily responsible for student recruitment for this articulation agreement program. As required, the appropriate Swanson School of Engineering faculty and staff will be available by telephone and e-mail to assist Gettysburg College students, faculty and staff.

All descriptive literature, promotional material or advertising material developed by Gettysburg College describing or discussing this articulation agreement program should be submitted to the Senior Associate Dean for Academic Affairs at the University of Pittsburgh, Swanson School of Engineering for review and approval prior to publication and distribution. Approval by the University of Pittsburgh for such material and literature will not be unreasonably delayed.

### ***Application for Admission***

Students admitted to this program should have a strong background in science and mathematics in order to be competitive for transfer to the University of Pittsburgh. They should complete the prescribed courses from the Articulation Agreement Curriculum Guide at Gettysburg College during their first three years at Gettysburg College in order to be able to complete the University of Pittsburgh course work in the appropriate time.

A transfer application for admission should be requested from:  
The Office of Admissions and Financial Aid  
4227 Fifth Avenue  
Pittsburgh, PA 15213  
(412) 624-PITT

A transfer application may also be accessed on-line from <http://www.oafa.pitt.edu/transadm.aspx>.

Additional information may be found at <http://www.oafa.pitt.edu/>

Completed application materials must indicate that the student is following the terms of this articulation agreement and must be submitted by July 15 for consideration for Fall semester admission, October 31 for Spring admission and March 15 for Summer admission. A recommendation from the Gettysburg College Articulation Agreement Program Liaison is also required and should be sent along with the application materials.

Ideally, the student should indicate interest in the program during his/her first year at Gettysburg College. He/she should consult with the Articulation Agreement Program Liaison to make sure that the appropriate courses are taken. During the student's second year, the Gettysburg College Articulation Agreement Program Liaison should inform the Swanson School of Engineering of the student's intent to transfer and indicate the engineering program of interest.

### ***Candidate Selection***

The Swanson School of Engineering agrees to review in an expeditious and non-prejudicial manner those students who follow the articulation agreement between the University of Pittsburgh, Swanson School of Engineering and Gettysburg College.

To be guaranteed admission to the University of Pittsburgh, Swanson School of Engineering, students must meet the following requirements:

- The student must have been enrolled at Gettysburg College for at least the past two years.
- The student must have received an overall GPA of 3.0 or higher as calculated on a 4.0 scale. Students intending on applying to Bioengineering must have received a cumulative GPA of 3.5 or higher.
- The student must have received a favorable recommendation from the Articulation Agreement Program Liaison at Gettysburg College. This recommendation must be included in the student's application packet to the University of Pittsburgh's Office of Admissions and Financial Aid.
- The student must have successfully completed the specific science and math prerequisite courses for the intended major listed in the University of Pittsburgh, Swanson School of Engineering Articulation Agreement Curriculum Guide with a recalculated GPA of 3.0 or higher in these courses and a grade of C or better in each course.\*
- The student must have completed or plan to complete the major requirements prescribed by Gettysburg College for graduation.

Students must complete their last thirty credits at the University of Pittsburgh. A grade of "C" or better must be earned in the prescribed courses in order to receive transfer credit and be eligible to fall under this agreement. Courses in which a grade of C- or lower was received will not be counted for transfer credit.

### ***\*Students Unable to Complete Articulation Agreement Curriculum Guide***

If a student is unable to complete the prescribed curriculum at Gettysburg College due to the fact that some courses are not offered at Gettysburg College, students will still be considered for admission based on the University of Pittsburgh Office of Admissions and Financial Aid's transfer student guidelines. Information regarding the standard transfer student guidelines may be obtained by the University of Pittsburgh's Office of Admissions and Financial Aid.

### ***Statute of Limitations***

All course work must be completed within the 12-year statute of limitations for the University of Pittsburgh.

### ***Course Selection***

The University of Pittsburgh, Swanson School of Engineering will provide an Articulation Agreement Curriculum Guide to guide students at Gettysburg College regarding their course selection.

Gettysburg College Articulation Agreement Program Liaison should work to make sure that the students interested in this program are taking the appropriate courses as prescribed in the Articulation Agreement Curriculum Guide. Questions about transferability of courses should be made to the University of Pittsburgh, Swanson School of Engineering's Coordinator of Transfer Student Services.

The University of Pittsburgh, Swanson School of Engineering's Coordinator of Transfer Student Services will update Gettysburg College of all curriculum changes as related to the Articulation Agreement Curriculum Guide. The provisions and contents of this document are subject to change at any time at the University of Pittsburgh's sole discretion. The University of Pittsburgh will make reasonable efforts to allow students already in the articulation agreement program at the time changes are made, to complete the program under the conditions in effect at the time of their enrollment in the program.

### ***Advising Services***

Gettysburg College's appropriate advisors and associated faculty will advise students during the first three years. Students may also contact the University of Pittsburgh, Swanson School of Engineering's Coordinator of Transfer Student Services for appropriate advisement regarding transferability of courses.

### ***Student Services***

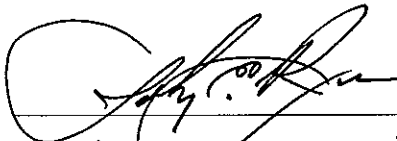
Students transferring from an articulation program to the University of Pittsburgh, Swanson School of Engineering will be treated on an equal basis with current Swanson School of Engineering students with regard to selection of courses and other student services. Transferring students will also have the Coordinator of Transfer Student Services available for questions regarding their assimilation to the University of Pittsburgh. Transfer students are also encouraged to enroll in an Engineering Transfer Seminar during their first semester at the University of Pittsburgh.

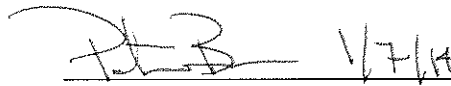
**Terms of the Agreement**

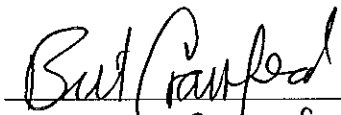
The liaisons from both institutions will review this agreement annually, revising it if necessary. An extensive review will take place five years from the date of signing. Attachments regarding curriculum requirements should be reviewed as required.

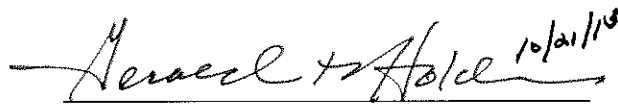
Lacking such a review, the agreement will continue until either the Dean of Gettysburg College or the Dean of the Swanson School of Engineering receives written notification of termination. Students enrolled in this program at the time of termination shall be allowed to proceed according to the policies outlined previously in this agreement.

Acting for our respective institutions, we accept the terms of the above agreement.

 10/31/2013  
\_\_\_\_\_  
(Date)  
John E. Ryan  
\_\_\_\_\_  
Vice Provost  
\_\_\_\_\_  
Gettysburg College

 1/7/14  
\_\_\_\_\_  
(Date)  
Patricia E. Beeson, PhD  
Provost and Senior Vice Chancellor  
University of Pittsburgh

 10/31/2013  
\_\_\_\_\_  
(Date)  
Bret Crawford  
\_\_\_\_\_  
Dual Degree Liaison  
\_\_\_\_\_  
Gettysburg College

 10/21/13  
\_\_\_\_\_  
(Date)  
Gerald D. Holder, PhD  
U.S. Steel Dean of Engineering  
Swanson School of Engineering  
University of Pittsburgh

## Contacts

**For assistance with administrative policies and procedures:**

**Contact the Swanson School of Engineering's Senior Associate Dean's Office:**

Larry Shuman, PhD  
Senior Associate Dean for Academic Affairs  
Swanson School of Engineering  
[shuman@pitt.edu](mailto:shuman@pitt.edu)

Pamela Rikstad  
Administrative Assistant to the Senior Associate Dean  
[pjr10@pitt.edu](mailto:pjr10@pitt.edu)  
P: 412-624-9815  
F: 412-624-1108

**For assistance with transfer admission and course content questions:**

**Contact the Swanson School of Engineering's First Year Program Office:**

Christopher Kirchhof  
Coordinator for Transfer Student Services, Swanson School of Engineering  
University of Pittsburgh  
152B Benedum Hall  
Pittsburgh, PA 15261  
[chk63@pitt.edu](mailto:chk63@pitt.edu)  
P: 412-624-9825  
F: 412-624-2827

**For assistance with student records questions:**

**Contact the Swanson School of Engineering Office of Administration:**

Rama Bazaz  
Director, Office of Administration  
Swanson School of Engineering  
University of Pittsburgh  
151 Benedum Hall  
[paurb4@pitt.edu](mailto:paurb4@pitt.edu)  
P: 412-624-9800  
F: 412-624-9808

**For additional information about the University of Pittsburgh, visit our web site(s):**

University of Pittsburgh (<http://www.pitt.edu/>)  
Swanson School of Engineering (<http://www.engineering.pitt.edu/>)  
Office of Admissions and Financial Aid (<http://www.oafa.pitt.edu/>)

# The University of Pittsburgh Swanson School of Engineering Articulation Agreement Curriculum Guide

*The equivalents of the following course are required for students to satisfy the terms of the Articulation Agreement. Students must complete the foundation engineering courses required for all majors as well as the required courses for their intended major. Please email the Swanson School of Engineering's Coordinator for Transfer Student Services with questions regarding course equivalencies. If your institution does not offer a required course listed in this guide, please contact your Articulation Agreement Program Liaison about other ways to fulfill these requirements.*

## ***Foundation Engineering Courses Required for All Majors:***

### Mathematics

- Calculus 1 – 4 credits (MATH 0220)
- Calculus 2 – 4 credits (MATH 0230)

### Physics

- Basic Physics for Science and Engineers 1 – 4 credits (PHYS 0174)
- Basic Physics for Science and Engineers 2 – 4 credits (PHYS 0175)

### Chemistry

- General Chemistry 1 – 4 credits (CHEM 0110)
- General Chemistry 2 – 4 credits (CHEM 0120)
  - *All engineering students are required to complete one semester of chemistry lab at a minimum. If the home institution offers the class and lab separate, students must take at least one lab.*

### Engineering / Computer Science

- Engineering Analysis (Programming in HTML & Excel) – 3 credits (ENGR 0011)
  - *Alternative engineering classes may fill this requirement with approval of University of Pittsburgh, Swanson School of Engineering's Coordinator of Transfer Student Services.*
- Engineering Computing (Programming in C & MATLAB) – 3 credits (ENGR 0012)

### Humanities & Social Sciences

- 6 courses totaling 18 credits (or more) of non-technical coursework taken to satisfy the Bachelor's degree awarded by the home institution. Among these courses, students must take:
  - Courses from 3 different academic disciplines.
  - 2 courses from the same department or theme. 1 of these courses must be non-introductory.



## ***REQUIRED FOR ALL MAJORS IN:***

### **Bioengineering**

#### Mathematics

- Calculus 3 – 4 credits (MATH 0240)
- Matrices & Linear Algebra – 3 credits (MATH 0280)
- Differential Equations – 3 credits (MATH 0290)

#### Chemistry

- Organic Chemistry 1 w/ Lab – 3 + 1 credits (CHEM 0310 & 0330)
- Organic Chemistry 2 w/ Lab – 3 + 1 credits (CHEM 0320 & 0340)
  - *Optional, but recommended for students interested in medical school.*

#### Biological Sciences

- Human Physiology – 3 credits (BIOSC 1250)
- Biology 1 Lab – 1 credit (BIOSC 0050)

#### Engineering

- Probability and Statistics for Engineers 1 – 4 credits (ENGR 0020)
  - *Please note that this course must have Calculus as a prerequisite. This course CANNOT be satisfied through Advanced Placement credit.*
- Statics and Mechanics of Materials 1 – 3 credits (ENGR 0135)

#### Engineering/Science Electives

- Two courses (6 credits total) in advanced life science, computer science, mathematics, or co-operative education programs. These courses must be approved by the University of Pittsburgh, Swanson School of Engineering's Coordinator of Transfer Student Services.
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## Chemical Engineering

### Mathematics

- Calculus 3 – 4 credits (MATH 0240)
- Differential Equations – 3 credits (MATH 0290)

### Chemistry

- Organic Chemistry 1 w/ Lab – 3 + 1 credits (CHEM 0310 & 0330)
- Organic Chemistry 2 w/ Lab – 3 + 1 credits (CHEM 0320 & 0340)
  - *Laboratory portion optional, but recommended for students interested in medical school*
- Intermediate Physical Chemistry – 3 credits (CHEM 1480)
- Biochemistry – 3 credits (CHE 1530 or BIOSC 1000)

### Advanced Science (*Choose one course below*)

- Cell Biology – 3 credits (BIOSC 1500)
- Molecular Biology – 3 credits (BIOSC 1940)
- Introduction to Analytical Chemistry – 3 credits (CHEM 0250)
- Inorganic Chemistry – 3 credits (CHEM 1130)
- Synthesis & Characterization of Polymers – 3 credits (CHEM 1600)
- *Alternative science classes may fill this requirement with approval of University of Pittsburgh, Swanson School of Engineering's Coordinator of Transfer Student Services*

### Advanced Science Lab (*Choose one course below*)

- Introduction to Analytical Chemistry Lab – 1 credit (CHEM 0260)
- Organic Chemistry 2 Lab – 1 credit (CHEM 0330)
- Physical Chemistry Lab 2 – 1 credit (CHEM 1440)
- Synthesis & Characterization of Polymers Lab – 1 credit (CHEM 1605)
- *Alternative science labs may fill this requirement with approval of University of Pittsburgh, Swanson School of Engineering's Coordinator of Transfer Student Services*

### Engineering

- Probability and Statistics for Engineers 1 – 4 credits (ENGR 0020)
  - *Please note that this course must have Calculus as a prerequisite. This course CANNOT be satisfied through Advanced Placement credit.*

### Engineering Elective (*Choose one course below*)

- Materials Structure and Properties – 3 credits (ENGR 0022)
- Statics and Mechanics of Materials 1 – 3 credits (ENGR 0135)
- Linear Systems and Circuits 1 – 3 credits (COE/ECE 0031)

### Professional Electives

- Two courses (6 credits total) in communication, advanced life science, computer science, math, or co-op education program. This course must be approved by the University of Pittsburgh, Swanson School of Engineering's Coordinator of Transfer Student Services.

## Civil & Environmental Engineering

### Mathematics

- Calculus 3 – 4 credits (MATH 0240)
- Differential Equations – 3 credits (MATH 0290)

### Economics

- Introduction to Microeconomic Theory – 3 credits (ECON 0100)

### Engineering

- Probability and Statistics for Engineers 1 – 4 credits (ENGR 0020)
  - *Please note that this course must have Calculus as a prerequisite. This course CANNOT be satisfied through Advanced Placement credit.*
- Statics for Civil & Environmental Engineers – 3 credits (ENGR 0131)
- Mechanics of Materials for Civil & Environmental Engineers – 3 credits (ENGR 0141)
- Dynamics for Civil & Environmental Engineering – 3 credits (ENGR 0151)
- Computer Methods in Civil & Environmental Engineering 1 – 3 credits (CEE 0109)
- Engineering Economic Analysis – 3 credits (IE 1040)

### Engineering Elective (*Choose one course below*)

- Principles of Modern Physics 1 – 3 credits (PHYS 0480)
- Linear Systems and Circuits – 3 credits (COE/ECE 0031)
- Digital Logic – 3 credits (COE/ECE 0132)
- Introduction to Thermodynamics – 3 credits (MEMS 0051)

### Science Elective (*Choose one course below*)

- Foundations of Biology 1 – 3 credits (BIOSC 0150)
  - Ecology – 3 credits (BIOSC 0370)
  - Biochemistry – 3 credits (BIOSC 1000)
  - Microbiology – 3 credits (BIOSC 1850)
  - Organic Chemistry 1– 3 (CHEM 0310)
  - Physical Geology – 3 credits (GEOL 0040)
  - Geology – 3 credits (GEOL 0800)
  - Environmental Geology – 3 credits (GEOL 0860)
  - Physical Oceanography – 3 credits (GEOL 0890)
  - GIS, GPS, and Computer Methods – 3 credits (GEOL 1445)
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## Computer Engineering

### Mathematics

- Matrices & Linear Algebra – 3 credits (MATH 0280)
- Differential Equations – 3 credits (MATH 0290)

### Engineering / Computer Science

- Introduction to JAVA – 4 credits (COE/CS 0401)

### Communications (*Choose one course below*)

- Argument – 3 credits (COMMRC 0500)
- Public Speaking – 3 credits (COMMRC 0520)
- Discussion – 3 credits (COMMRC 0540)
- Written Professional Communication – 3 credits (ENGCMP 0400)
- Research Writing – 3 credits (ENGCMP 0450)
- Persuasive Writing – 3 credits (ENGCMP 0515)
- Communication Skills for Engineers – 3 credits (ENGR 1010)

### Technical Electives

- Two courses (6 credits total) in advanced life science, computer science, math or co-op education program. These courses must be approved by the University of Pittsburgh, Swanson School of Engineering's Coordinator of Transfer Student Services.

### Open Electives

- Any two courses (6 credits total) that are NOT of a similar nature to, or lower level than, a required or previously taken course can be used to fulfill this requirement. Three credits of Physical Education or three credits of Band, ROTC, or Chorus may also be used as an open elective.
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## Electrical Engineering

### Mathematics

- Calculus 3 – 4 credits (MATH 0240)
- Matrices & Linear Algebra – 3 credits (MATH 0280)
- Differential Equations – 3 credits (MATH 0290)

### Engineering / Computer Science

- Probability and Statistics for Engineers 1 – 4 credits (ENGR 0020)
  - *Please note that this course must have Calculus as a prerequisite. This course CANNOT be satisfied through Advanced Placement credit.*

### Communications (*Choose one course below*)

- Argument – 3 credits (COMMRC 0500)
- Public Speaking – 3 credits (COMMRC 0520)
- Discussion – 3 credits (COMMRC 0540)
- Written Professional Communication – 3 credits (ENGCMP 0400)
- Research Writing – 3 credits (ENGCMP 0450)
- Persuasive Writing – 3 credits (ENGCMP 0515)
- Communication Skills for Engineers – 3 credits (ENGR 1010)

### Technical Electives

- Three courses (9 credits total) in advanced life science, computer science, or mathematics program. These courses must be approved by the University of Pittsburgh, Swanson School of Engineering's Coordinator of Transfer Student Services.

### Open Elective

- Any course (3 credits total) that are NOT of a similar nature to, or lower level than, a required or previously taken course can be used to fulfill this requirement. Three credits of Physical Education or three credits of Band, ROTC, or Chorus may also be used as an open elective.
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## Engineering Science – Engineering Physics Emphasis

### Mathematics

- Calculus 3 – 4 credits (MATH 0240)
- Matrices & Linear Algebra – 3 credits (MATH 0280)
- Differential Equations – 3 credits (MATH 0290)
- Complex Variables and Applications – 3 credits (MATH 1560)

### Physics

- Basic Laboratory Physics for Science & Engineers – 2 credits (PHYS 0219)
- Principles of Modern Physics 1 – 3 credits (PHYS 0480)
- Principles of Modern Physics 2 – 3 credits (PHYS 0481)
- Mechanics – 3 credits (PHYS 1331)
- Intermediate Electricity and Magnetism – 3 credits (PHYS 1351)
- Wave Motion & Optics – 3 credits (PHYS 1361)

### Engineering

- Probability and Statistics for Engineers 1 – 4 credits (ENGR 0020)
    - *Please note that this course must have Calculus as a prerequisite. This course CANNOT be satisfied through Advanced Placement credit.*
  - Materials Structure and Properties – 3 credits (ENGR 0022)
  - Linear Systems and Circuits 1 – 3 credits (COE/ECE 0031)
  - Linear Systems and Circuits 2 – 3 credits (COE/ECE 0041)
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## Engineering Science – Nanotechnology: Chemistry/Bioengineering Emphasis

### Mathematics

- Calculus 3 – 4 credits (MATH 0240)
- Matrices & Linear Algebra – 3 credits (MATH 0280)
- Differential Equations – 3 credits (MATH 0290)
- Complex Variables and Applications – 3 credits (MATH 1560)

### Chemistry (*Choose three courses below*)

- Organic Chemistry 1 w/ Lab – 3 + 1 credits (CHEM 0310 & 0330)
- Organic Chemistry 2 w/ Lab – 3 + 1 credits (CHEM 0320 & 0340)
  - *Laboratory portion optional, but may be co-requisite at transferring institution*
- Inorganic Chemistry -3 credits (CHEM 1130)
- Physical Chemistry 1 – 3 credits (CHEM 1410)
- Physical Chemistry 2 – 3 credits (CHEM 1420)
- Biochemistry – 3 credits (BIOSC 1000)

### Engineering

- Probability and Statistics for Engineers 1 – 4 credits (ENGR 0020)
    - *Please note that this course must have Calculus as a prerequisite. This course CANNOT be satisfied through Advanced Placement credit.*
  - Materials Structure and Properties – 3 credits (ENGR 0022)
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## Engineering Science – Nanotechnology: Physics/Materials Emphasis

### Mathematics

- Calculus 3 – 4 credits (MATH 0240)
- Matrices & Linear Algebra – 3 credits (MATH 0280)
- Differential Equations – 3 credits (MATH 0290)
- Complex Variables and Applications – 3 credits (MATH 1560)

### Physics

- Basic Laboratory Physics for Science & Engineers – 2 credits (PHYS 0219)
- Principles of Modern Physics 1 – 3 credits (PHYS 0480)
- Principles of Modern Physics 2 – 3 credits (PHYS 0481)
  
- Intermediate Electricity and Magnetism – 3 credits (PHYS 1351)  
OR
- Wave Motion & Optics – 3 credits (PHYS 1361)

### Engineering

- Probability and Statistics for Engineers 1 – 4 credits (ENGR 0020)
    - *Please note that this course must have Calculus as a prerequisite. This course CANNOT be satisfied through Advanced Placement credit.*
  - Materials Structure and Properties – 3 credits (ENGR 0022)
  - Linear Systems and Circuits 1 – 3 credits (COE/ECE 0031)
  - Linear Systems and Circuits 2 – 3 credits (COE/ECE 0041)
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## Industrial Engineering

### Mathematics

- Calculus 3 – 4 credits (MATH 0240)
- Matrices & Linear Algebra – 3 credits (MATH 0280)
- Differential Equations – 3 credits (MATH 0290)

### Engineering

- Probability and Statistics for Engineers 1 – 4 credits (ENGR 0020)
  - *Please note that this course must have Calculus as a prerequisite. This course CANNOT be satisfied through Advanced Placement credit.*
- Introduction to Information Systems Engineering – 3 credits (IE 0015)
- Engineering Economic Analysis – 3 credits (IE 1040)
- Probability and Statistics for Engineers 2 – 4 credits (IE 1071)

### Engineering (*Maximum of 3 courses listed below*)

- Materials Structure and Properties – 3 credits (ENGR 0022)
- Statics and Mechanics of Materials 1 – 3 credits (ENGR 0135)
- Linear Systems and Circuits 1 – 3 credits (COE/ECE 0031)
- Introduction to Thermodynamics – 3 credits (MEMS 0051)

### Communications (*Choose one course below*)

- Argument – 3 credits (COMMRC 0500)
- Public Speaking – 3 credits (COMMRC 0520)
- Discussion – 3 credits (COMMRC 0540)

### Technical Electives

- Two courses (6 credits total) in advanced life science, computer science, math or co-op education program. These courses must be approved by the University of Pittsburgh, Swanson School of Engineering's Coordinator of Transfer Student Services.
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## Materials Science & Engineering

### Mathematics

- Calculus 3 – 4 credits (MATH 0240)
- Matrices & Linear Algebra – 3 credits (MATH 0280)
- Differential Equations – 3 credits (MATH 0290)

### Engineering

- Statics – 3 credits (ENGR 0131)
- Mechanics of Materials – 3 credits (ENGR 0141)
- Electrical Circuits – 3 credits (MEMS 0031)
- Probability & Statistics for Engineers 1 – 4 credits (ENGR0020)
  - *Please note that this course must have Calculus as a prerequisite. This course CANNOT be satisfied through Advanced Placement credit.*

### Communications (*Choose one course below*)

- Argument – 3 credits (COMMRC 0500)
- Public Speaking – 3 credits (COMMRC 0520)
- Discussion – 3 credits (COMMRC 0540)
- Written Professional Communication – 3 credits (ENGCMP0400)
- Communication Skills for Engineers – 3 credits (ENGR1010)

### Philosophy

- Introduction to Ethics – 3 credits (PHIL 0300)
    - *This course may be counted as one of the six required humanities / social science courses.*
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## Mechanical Engineering

### Mathematics

- Calculus 3 – 4 credits (MATH 0240)
- Matrices & Linear Algebra – 3 credits (MATH 0280)
- Differential Equations – 3 credits (MATH 0290)

### Engineering

- Statics – 3 credits (ENGR 0131)
- Mechanics of Materials – 3 credits (ENGR 0141)
- Electrical Circuits – 3 credits (MEMS 0031)
- Dynamics – 3 credits (MEMS 1015)

### Communications (*Choose one course below*)

- Argument – 3 credits (COMMRC 0500)
- Public Speaking – 3 credits (COMMRC 0520)
- Discussion – 3 credits (COMMRC 0540)
- Written Professional Communication – 3 credits (ENGCMP0400)
- Communication Skills for Engineers – 3 credits (ENGR1010)

### Philosophy

- Introduction to Ethics – 3 credits (PHIL 0300)
    - *This course may be counted as one of the six required humanities / social science courses.*
-

## Course Descriptions

### Chemistry

**CHEM 0110 General Chemistry 1 (4 credits)** This is the first half of an introductory two-term general chemistry sequence. It includes 3 hours of lecture per week and one 4-hour session per week comprising one hour of recitation and 3 hours of laboratory. Chemistry 0110 covers stoichiometry, atomic and molecular structure, and states of matter. (*Prerequisite: High School Algebra*)

**CHEM 0120 General Chemistry 2 (4 credits)** This is the second half of the introductory two-term general chemistry sequence. It includes 3 hours of lecture per week and one 4 hour session per week comprising one hour of recitation and 3 hours of laboratory. Chemistry 0120 covers chemical thermodynamics, equilibrium, electrochemistry, nuclear chemistry, kinetics, and descriptive chemistry. (*Prerequisite: CHEM 0110*)

**CHEM 0250 Introduction to Analytical Chemistry (3 credits)** This course is concerned with the rigorous treatment of chemical equilibrium as it applies to aqueous solutions. Acid/base equilibria, buffers, titrations, absorption spectrophotometry, potentiometry and potentiometric sensors, chromatography and electrophoresis will be discussed. Three hours of lecture per week. (*Prerequisite: CHEM 0120*)

**CHEM 0260 Introduction to Analytical Chemistry Lab (1 credit)** The primary objectives of this course are to introduce the student to current analytical methods and to cultivate sound experimental technique. Laboratory work includes ion-exchange separations, complexometric and potentiometric acid-base titrations, absorption spectrophotometry and gas chromatography.

**CHEM 0310 Organic Chemistry 1 (3 credits)** This course is an introduction to the theory and practice of organic chemistry through the study of structural principles, reaction mechanisms, and synthesis. The basic goals of the course are to develop appreciation and skill in the methods of molecular analysis which have made organic chemistry such a powerful intellectual discipline. Topics covered will include conformational analysis of alkanes, stereochemistry and various reactions of alkanes, alkenes, alkynes, and conjugated systems. The course will prepare the student for work in advanced topics in organic chemistry, biochemistry, chemical engineering and the health related sciences. (*Prerequisite: CHEM 0120*)

**CHEM 0320 Organic Chemistry 2 (3 credits)** This course is a continuation of Chemistry 0310. The reactions of aromatic molecules and more complex functional groups such as alcohols, aldehydes, ketones and carboxylic acids will be considered. Molecules of biological interest may be discussed toward the end of the term. (*Prerequisite: CHEM 0310*)

**CHEM 0330 Organic Chemistry Laboratory 1 (1 credit)** The laboratory program in organic chemistry is designed to train students in the important techniques used by the professional organic chemist and to demonstrate many of the principles discussed in the organic lecture courses. Chemistry 0330 is devoted to the purification, characterization, and identification of organic molecules using the techniques of recrystallization distillation, thin-layer, column, and

gas-liquid chromatography, melting point determination and infrared and nuclear magnetic resonance spectroscopy. (*Prerequisite or Co-requisite: CHEM 0310*)

**CHEM 0340 Organic Chemistry Laboratory 2 (1 credit)** The second term organic lab course, Chem 0340, provides students with an opportunity to carry out important multistep synthetic schemes and characterize the products using techniques mastered in Chemistry 0330. Students will also gain experience using library resources and developing skills in computer based molecular modeling. (*Prerequisite or Co-requisite: CHEM 0320*)

**CHEM 1130 Inorganic Chemistry (3 credits)** Molecular orbital and hybridization bonding theories are developed to allow the interrelationship of molecular structure, bonding, and trends within the periodic table to be applied to a large number of inorganic complexes and materials. Topics include drawing connections between molecular shapes and group theory in regards to MO's that support certain geometries of complexes. Bonding interactions are connected to spectral and chemical properties for molecules. Common structures of ionic solids and condensed phase materials, the acid/base behavior of ligands in both sigma and pi bonding modes, and introductory transition metal and organometallic chemistry are discussed. The interaction between a metal's  $d_n$  configuration, its requisite ligands, its reactivity and structures of its complexes are stressed.

**CHEM 1410 Physical Chemistry 1 (3 credits)** Basic lecture course dealing with quantum theory, atomic and molecular structure, symmetry, spectroscopy and diffraction methods. Three hours of lecture per week. (*Prerequisites: CHEM 0120, PHYS 0175, and MATH 0240*)

**CHEM 1420 Physical Chemistry 2 (3 credits)** Basic lecture course dealing with thermodynamics, equilibria, kinetic theory, introductory statistical mechanics and reaction kinetics.

**CHEM 1440 Physical Chemistry Lab 2 (1 credit)** This course has one four hour lab each week. Approximately 7 experiments are performed during the term, with an emphasis on the macroscopic properties of matter. The course is designed to expand upon the principles and techniques covered in Chemistry 1430 as well as to introduce the student to newer methods such as the study of fast reactions using pulsed dye lasers.

**CHEM 1480 Intermediate Physical Chemistry (3 credits)** This lecture course emphasizes the applications of physical chemistry of importance to engineering students. (*Prerequisites: CHEM 0120, MATH 0240, and PHYS 0175*)

**CHEM 1600 Synthesis & Characteristics of Polymers (3 credits)** The synthesis and characterization of polymers is the focus of this course. Current methods of polymer synthesis will be surveyed. Particular attention will be paid to the practical implementation of these reactions and the kinetic consequences of particular reaction strategies in homopolymer, copolymer, and block copolymer synthesis. Techniques for the characterization of polymer molecular weight (light scattering, gel permeation chromatography, vapor pressure osmometry, viscosity, etc.), chemical composition, and stereochemistry (FT-IR, NMR, other spectroscopic

and chemical methods) will be discussed. A brief treatment of polymer solution thermodynamics and selected topics of current interest in polymer chemistry will be included.

**CHEM 1605 Synthesis & Characteristics of Polymers Lab (1 credit)** This course includes a weekly 4 hour laboratory complementing the lecture material covered in Chemistry 1600. The laboratory is divided evenly between polymer synthesis and characterization.

### Mathematics

**MATH 0220 Calculus 1 (4 credits)** This is the first course in the basic calculus sequence and is intended for all mathematics, engineering, science, and statistics students. Math 0220 covers the derivative and integral of functions of a single variable. A lab component in which students apply numeric, algebraic, and graphing technologies to calculus problems is an integral part of the course. For additional information refer to the web page <http://calculus.math.pitt.edu>.

**MATH 0230 Calculus 2 (4 credits)** This is the second course in the basic calculus sequence and is intended for all mathematics, engineering, science, and statistics students. Math 0230 covers symbolic and numerical integration techniques and applications, modeling, differential equations, and Taylor series. A lab component in which students apply numeric, algebraic, and graphing technologies to calculus problems is an integral part of the course. (*Prerequisite: MATH 0220*)

**MATH 0240 Calculus 3 (4 credits)** This is the third course in the calculus sequence and is intended for honors students majoring in mathematics, engineering, science and statistics. It covers vectors, parameterized curves and surfaces, differentiation of functions of several variables, optimization, integration of functions of two and three variables, line integrals, flux integrals, and calculus of vector fields. (*Prerequisite: MATH 0230*)

**MATH 0280 Matrices & Linear Algebra (3 credits)** This course is designed primarily for engineering students. The main subject of the course is ordinary differential equations. Topics include first order differential equations, higher order linear differential equations and systems of first order linear and nonlinear differential equations. Matrix methods will be introduced and used to solve systems of linear equations. The computer package MATLAB will be used to assist in computations. (*Prerequisite: MATH 0220*)

**MATH 0290 Differential Equations (3 credits)** This course presents an introduction to the theory of differential equations from an applied perspective. Topics include linear and nonlinear ordinary differential equations, Laplace transform, and introduction to partial differential equations. (*Prerequisite: MATH 0230*)

**MATH 1560 Complex Variables and Applications (3 credits)** This course covers the following topics: elementary operations with complex numbers, derivatives, integrals, Cauchy's Theorem and its consequences such as the integral formula, power series, residue theorem, applications to real integrals, series and, as time allows, conformal mapping.

### Physics

**PHYS 0174 Basic Physics for Science and Engineers 1 (4 credits)** The first term in a two-term introductory lecture-demonstration sequence in physics for science and engineering students. Subjects covered in Physics 0174 include: kinematics; Newton's laws of motion; energy; momentum, rotational motion, rigid body motion, angular momentum, simple harmonic motion, gravitation, mechanical waves, sound waves, and the kinetic theory of gases. (*Prerequisite or Co-requisite: MATH 0220*)

**PHYS 0175 Basic Physics for Science and Engineers 2 (4 credits)** This is the second term in a two-term introductory sequence in physics for science and engineering students. Subjects covered in Physics 0175 include: electrostatics, electric currents, magnetism, induction, simple AC circuits, Maxwell's equations, electromagnetic waves, geometric and wave optics, followed by an introduction to quantum physics, including photons, the Bohr atom and spectra, and elementary wave mechanics. (*Prerequisite: PHYS 0174; Prerequisite or Co-requisite: MATH 0230*)

**PHYS 0219 Basic Laboratory Physics for Science & Engineers (2 credits)** This is the introductory course in physics laboratory associated with Physics 0174, 0175. The course involves carrying out experiments in mechanics, electricity, heat, sound, optics, atomic physics, nuclear physics, and quantum physics. The student then gets insight into the collection, interpretation and presentation of experimental data and into the assessment of errors.

**PHYS 0480 Principles of Modern Physics 1 (3 credits)** This first term of a two-term sequence in modern physics will cover: Special Relativity, experimental quantum effects which led to the development of Quantum Theory, an introduction to Quantum Mechanics and the quantum theory of atomic structure.

**PHYS 0481 Principles of Modern Physics 2 (3 credits)** This course (follow up to Physics 0479, Modern Physics 1) will cover the following topics: quantum mechanics of many particle systems, multielectron atoms and the periodic table, basics of quantum statistical mechanics, introduction to solid state physics (conductors, semiconductors, superconductors), basic nuclear physics, introduction to elementary particle physics.

**PHYS 1331 Mechanics (3 credits)** This course aims to discuss the principles of Newtonian mechanics and to develop these principles and their applications as far as Lagrangian and Hamiltonian dynamics. Various ways of formulating the equations of motion and of solving some specific problems will be developed.

**PHYS 1351 Intermediate Electricity and Magnetism (3 credits)** Vector calculus, electrostatics, including Poisson's and Laplace's equations and associated boundary conditions and boundary value problems, Electric current, Lorentz force law, Magnetic field and Biot-Savart Law, Electromagnetic induction, Maxwell's equations, E and B in matter.

**PHYS 1361 Wave Motion & Optics (3 credits)** This combined lab/lecture course introduces the student to classical wave phenomena, with most examples taken from optics and electromagnetism. The laboratory component of the course consists of a series of eight mandatory experiments, two on geometrical, six on wave optics, followed by two special

projects, chosen by the student. Two weekly one-hour lectures will present the theory of geometrical and wave optics and discuss experimental aspects of the lab projects.

## **Engineering**

**ENGR 0011 Introduction to Engineering Analysis (3 credits)** Introduction to engineering analysis and engineering design. Includes units and conversion factors, graphs, data analysis and curve fitting. Use of spreadsheets. Introduction to engineering analysis, including statics, strength of materials, electrical circuits, heat transfer, fluid mechanics, and introduction to rate phenomena. Applications to engineering design. Fundamentals of report writing.

**ENGR 0012 Engineering Computing (3 credits)** Course is designed to teach students the fundamentals of computing and the concept of engineering design as applied to the design of software. Fundamentals include basic computer organization, formulation of algorithms, basic data structures, pseudo-code, and top-down iterative refinement. In the concurrent laboratory, proficiency is developed in a high-level language and a text editor/word processor. The course includes material on the use of MATLAB and C++. (*Prerequisite: ENGR 0012*)

**ENGR 0020 Probability and Statistics for Engineers 1 (4 credits)** A basic course in probability and statistics. Topics covered include: data analysis, probability, random variables, discrete and continuous probability distributions, estimation, hypothesis testing, and regression analysis statistical process control. (*Prerequisite: MATH 0230*)

**ENGR 0022 Material Structures and Properties (3 credits)** An introduction to the basic concepts of materials science and engineering. The concepts of atomic, crystal, micro- and macro-structure, their control and effect on chemical, electrical, magnetic and mechanical properties. Modification of properties by heat treatment and control of processing. Fundamental considerations in materials selection.

**ENGR 0131 Statics for Civil & Environmental Engineers (3 credits)** A basic course in statics. Utilizing the free-body diagram. The course covers forces and equilibria of particles, rigid bodies, surfaces, trusses, beams, cables, and other basic structural elements. Use is made of computers for problem solving. (*Prerequisite: PHYS 0174*)

**ENGR 0135 Statics and Mechanics of Materials 1 (3 credits)** First of a two course sequence covering statics and strength of materials. Topics covered include: concurrent force systems, equilibrium, axial loading, stress, strain, deformation, moments, equivalent systems, centroids, centers of mass, and distributed loads, free-body diagrams, equilibrium of rigid and deformable bodies, plane trusses, frames and machines equilibrium in 3D, torsion and friction. Use is made of computers for problem solving.

**ENGR 0141 Mechanics of Materials for Civil & Environmental Engineers (3 credits)** An introductory course in the mechanics of deformable bodies, with special application to the range of topics needed by Civil Engineers. The course material covers internal strains, stresses and deformations, which occur when a structure is subjected to applied loads. Problems with tie-in to practical design issues will be covered. (*Prerequisite: ENGR 0131*)



**ENGR 0145 Statics & Mechanics of Materials 2 (3 credits)** An introductory course in the mechanics of deformable solids. Material covers the internal stresses, strains, and displacements that occur when a structure is subjected to applied loads. Open-ended design problems are presented and discussed. (*Prerequisite: ENGR 0135*)

**ENGR 0151 Dynamics for Civil & Environmental Engineers (3 credits)** A basic course in dynamics. Utilizing the Newtonian Mechanics of Particles, the course covers kinematics and kinetics of particles, kinetics of systems of particles, work and energy, introduction to vibrations, single-degree-freedom systems, and two-degrees-of-freedom systems. Applications of dynamics in civil engineering problems. Use is made of computer solution to a two-story building vibration. (*Prerequisites: ENGR 0141 and MATH 0290*)

**ENGR 1010 Communication Skills for Engineers (3 credit)** Utilizing a variety of spoken, written, and audio-video activities, the students learn how to give instructions, use feedback, listen, conduct the job and appraisal interview, run meetings, use groups, make presentations, manage crises. Most of the skills they need to strengthen their personal, interpersonal, group, and organizational communicative skills. The instructing-learning process emphasizes motivation, concentration, participation, organization, comprehension, repetition, articulateness, and confidence.

**CEE 0109 Computer Methods in Engineering 1 (3 credits)** This course teaches the use of CAD as a design tool. Coverage includes both 2D drawing, 3D drawing and rendering. Visual Basic programming is employed for constructing complex objects and to communicate with other programs. (*Co-requisite: ENGR 0012 and MATH 0240*)

**COE/ECE 0031 Linear Systems & Circuits 1 (3 credits)** The analysis of linear circuits. Electric variables and circuit elements, Kirchoff's and Ohm's Law, mesh and node equations, Thevenin and Norton Equivalent circuits. First and second-order circuits, time domain analysis. (*Prerequisites: PHYS 0175 and MATH 0230*)

**COE/ECE 0041 Linear Systems and Circuits 2 (3 credits)** Sinusoidal steady-state analysis, network functions, real and reactive power, three-phase circuits, Laplace transform method, two-port networks, and Fourier series. (*Prerequisite: ECE/COE 0031*)

**COE/ECE 0132 Digital Logic (3 credits)** Introduction to digital systems, Boolean algebra, minimization of logic functions, combinational and sequential circuit design. (*Prerequisite: PHYS 0175*)

**COE/ECE 0142 Computer Organization (3 credits)** Digital computer data representation, instruction formats, control, memory and input-output units, microprocessors, minicomputers. (*Prerequisite: ECE/COE 0132*)

**COE/CS 0401 Introduction to JAVA (4 credits)** This course is a rigorous introduction to the fundamental concepts and techniques of computer programming using the JAVA programming language.

**COE 0445 Data Structures (3 credits)** This course emphasizes the study of the basic data structures of computer science (stacks, queues, trees, lists) and their implementation using the JAVA language. Included in this study are programming techniques which use recursion, reference variables, and dynamic memory allocation. Students in this course are also introduced to various searching and sorting methods and are expected to develop an intuitive understanding of the complexity of these algorithms. (*Prerequisite: COE/CS 401*)

**COE/CS 1501 Algorithm Implementations (3 credits)** This course covers a broad range of the most commonly used algorithms. Some examples include algorithms for sorting, searching, encryption, compression and local search. The students will implement and test several algorithms. The course is programming intensive. (*Prerequisites: COE/CS 0441 and COE/CS 0445*)

**COE/CS 1541 Introduction to Computer Architecture (3 credits)** Examination of computer architecture and hardware system organization. Topics include: CPU organization, sequential and microprogrammed control, instruction set implementation, memory organizations, input/output structure, peripherals and interfacing, and computer communications. (*Prerequisite: CS 0449*)

**ECE 1259 Electromagnetics (3 credits)** Vector Calculus, Gradient Curl, Divergence Theorem and Stokes' Theorem, Coulomb's Law, Gauss's Law, Laplace Equation, Poisson Equation, Dielectrics, Biot-Savart Law, Vector Potentials, Ampere's Law, Faraday's Law, Inductance, Magnetic Materials, Lorentz Force, Maxwell's Equations, Electromagnetic Radiation. (*Prerequisites: PHYS 0175 and MATH 0240*)

**IE 0015 Introduction to Information Systems Engineering (3 credits)** This course introduces students to the major components comprising information systems including databases, graphical user interfaces and telecommunication protocols. Students will use a visual programming language, a relational database management system, and a network protocol to learn how to develop desktop information systems for industrial and service applications. The course will serve as a primer for advanced courses in each information system technology area. (*Prerequisite: ENGR 0012*)

**IE 1040 Engineering Economic Analysis (3 credits)** Discusses time value of money, interest rate calculations, economic equivalence concepts, cost of capital, comparison of alternate investments, evaluating economic life and replacement alternatives, inflation, depreciation, depletion, impact of taxes on engineering economic decisions. (*Prerequisite: MATH 0220*)

**IE 1071 Probability and Statistics for Engineers 2 (4 credits)** Review of joint distributions and estimation; Chi square, t, and F sampling distributions introduced; estimation hypothesis testing; multiple regression; empirical model building; analysis of variance and design of experiments; goodness-of-fit tests and contingency tables; introduction to statistical quality control. (*Prerequisite: ENGR 0020*)

**MEMS 0031 Electrical Circuits (3 credits)** The study of linear circuit networks, including constitutive equations for circuit elements and Ohm's and Kirchoff's laws. Mesh and node equations, Thevenin/Norton equivalents, maximum power transfer, transient and AC analyses, and operational amplifiers. (*Prerequisite: PHYS 0175. Co-requisite: MATH 0290*)

**MEMS 0051 Introduction to Thermodynamics (3 credits)** Synthesis of the basic concepts from thermodynamics and fluids, including: properties of pure substances, first law analysis, and introduction to the second law; fluid statics, kinematics, stress, and viscosity; and control volume analysis of the conservation equations. (*Prerequisites: PHYS 0174 and CHEM 0110. Co-requisite: MATH 0290*)

**MEMS 1014 Dynamic Systems (3 credits)** Modeling and analysis of physical systems. Time and frequency domain analysis. Transient and steady-state system response to various excitations. Transfer function and state space model representations. Laplace and Fourier transforms. (*Prerequisites: MATH 0280, ENGR 0012 and MEMS 0031*)

**MEMS 1051 Applied Thermodynamics (3 credits)** Thermodynamic processes, energy and entropy changes in real and ideal gases, vapors, and liquids, and mixtures of those fluids. Basic thermodynamic cycles (vapor and gas power, refrigeration, and heat pumps). Thermodynamic property relations. (*Prerequisite: MEMS 0051*)

**MEMS 1052 Heat & Mass Transfer (3 credits)** One and two-dimensional steady and unsteady-state conduction, empirical and practical relations for forced and natural convection. Principle of radiation using "radiation network" method. Heat exchangers and special topics. (*Prerequisite: MEMS 0051*)

**MEMS 1056 Energetics (3 credits)** Thermodynamics of solutions with applications to materials systems; heterogeneous phase equilibria; relations between free energy and phase diagrams; electrochemistry; rate processes; thermodynamics of surfaces. (*Prerequisites: ENGR 0022 and MEMS 0051*)

**MEMS 1058 Electromagnetic Properties of Materials (3 credits)** Review of basic principles quantum theory, band and zone theory. Transport, electrical, and thermal properties; semiconductors and semiconductor devices; magnetic materials hard and soft; dielectric and optical properties. (*Prerequisite: ENGR 0022*)

**MEMS 1072 Applied Fluid Dynamics (3 credits)** Kinematics of fluids. Navier-Stokes equations. Flow of incompressible, inviscid fluids. Dimensional analysis and similarity. Internal flows in pipes. Boundary layer theory. External flow past bodies. (*Prerequisite: MEMS 0051*)

### Other Courses

**BIOSC 0050 Foundation of Biology Lab 1 (1 credit)** This is the first course in a two-course sequence on the study of organisms in the laboratory. We will work with techniques that are important in biology and apply these techniques to illustrate basic biological principles

emphasizing cell biology. BIOSC 0050 runs concurrently with BIOSC 0150, the lecture complement in introductory biology.

**BIOSC 0150 Foundation of Biology (3 credits)** This introductory course in biology is divided into two parts. The first part covers the cellular basis of life including a discussion of simple chemistry; cells as units of structure and function; and energy transformations. The second part includes an examination of those functions common to all organisms such as nutrition, gas and fluid transport, and hormonal and neuronal control. Throughout, the emphasis is on the mechanisms used to accomplish these basic functions.

**BIOSC 0370 Ecology (3 credits)** The objective of the course is to provide a broad introduction to the study of ecology at the undergraduate level, through the presentation of lectures dealing with organismal, population, community, and ecosystem levels of hierarchical organization. The contributions of laboratory and field investigations to the development of ecological knowledge will be considered. (*Prerequisite: BIOSC 0160 or 0716 or 0180 or BIOL 0102 or 0120*)

**BIOSC 1000 Biochemistry (3 credits)** This course is designed to provide students with a basic understanding of the principles and underlying themes of modern biochemistry. The course includes all the major topics in biochemistry in considerable depth including thermodynamics and enzymology, protein and nucleic acid structure, function, and synthesis, lipids and membranes as well as metabolic pathways. This course will require that you master a new vocabulary including chemical structures, and there is an emphasis throughout on experimental approaches, molecular mechanisms, and protein solving.

**BIOSC 1250 Human Physiology (3 credits)** After a general introduction on cell biology, physiology of nerves and muscle, and intercellular communication, this course will survey the function of the following systems: cardiovascular, respiratory, renal, and gastrointestinal. Each system discussed will be integrated into the larger function of homeostasis and their adaptation during pathology and challenges (e.g., exercise).

**BIOSC 1500 Cell Biology (3 credits)** This course will be devoted to a discussion of the current state of our understanding of cell structure and function. Eukaryotic cells will be emphasized with particular attention to animal cells. However, prokaryotic cells will be discussed for comparative purposes. Course material will emphasize the experimental basis for our understanding of cell biology and the relationship between structure and function. Most of the techniques to be considered will involve biochemical and molecular biological approaches used in the study of cell function. Thus the course will assume a familiarity with the principles of biochemistry covered in the prerequisites and will not repeat this material. Topics will include membranes, the nucleus, mitochondria and chloroplasts, the cytoskeleton, cell motility, growth and division, endocytosis and exocytosis, and selected topics on the cellular biological aspects of cancer and the immune system.

**BIOSC 1850 Microbiology (3 credits)** This course will introduce students to the basic biology, diversity in types, and survival strategies of microorganisms. We will study basic topics, including microbial growth, metabolism, nutrition and genetics, as well as the relevance of microorganisms to human disease, biotechnology and environmental science. We will also pay

some attention to the diverse types of jobs available to persons interested in microbiology. This course will provide the necessary foundation for future studies in various areas of microbiology. *(Prerequisites: (BIOSC 0160 or 0716 or 0180 or BIOL 0102 or 0120) and [CHEM 0120 or 0720 or 0101 or (0112 and 0114)])*

**BIOSC 1940 Molecular Biology (3 credits)** This course will examine the molecular basis of life processes, with a primary emphasis on genes (what they are, what they do, how they determine the properties of an organism). Topics covered will include replication of DNA, transcription of DNA into RNA, and translation of RNA into protein. Much of the course will be concerned with how these processes are regulated in response to changes in the environment, and how this regulation relates to the observed properties and behavior of the organism.

**COMMRC 0500 Argument (3 credit)** This course introduces students to fundamental principles of argument, and develops argument skills through in-class debates.

**COMMRC 0520 Public Speaking (3 credits)** This course is designed to develop rhetorical understanding and increased skill in public speaking. Students will learn to research, organize, compose and deliver public speeches.

**COMMRC 0540 Discussion (3 credits)** The purpose of this course is to learn and sharpen discussion and critical thinking skills, which are absolutely essential elements in the process of group decision making. There is a clear trend in the modern world to reduce the decision making power of individuals and increase the influence of groups. This is a hands-on course that will give students practical experience in the process of group decision-making, a valuable and highly marketable skill.

**ECON 0100 Introduction to Microeconomics (3 credits)** This is a standard introductory course in microeconomics. It focuses on the way the market system works. The decisions of households, firms, and governments are coordinated through markets in which prices adjust to keep buying plans and selling plans consistent. The U.S. economy relies mainly on markets to coordinate these decisions, although sometimes governments intervene. We will explore various social issues using the principles developed throughout the course. Upon completion of the course students will have a better understanding of economic problems, efficiency, laws of demand and supply, consumer choice theory, market organization, production and cost.

**ENGCOMP 0400 Written Professional Communications (3 credits)** In this course we will examine the contexts for and rhetorical dimensions of a variety of professional documents, including those documents students produce in the course itself. Major assignments include a set of career materials (resume, cover letter, career report); a correspondence packet that addresses a conflict; a proposal; and a longer report based on research and analysis. As we engage in this work we will explore the nature of professionalism, common features and efforts (enabling and disabling) of professional discourse, and strategies for negotiating the "borders" of specialized and non-specialized discourse.

**ENGCOMP 0450 Research Writing (3 credits)** Fitting into the broader category of Cultural Studies, this course will engage the skills and methods of writing, researching, and thinking

critically across the curriculum. In responding to the ideas of others, including your classmates, you will be expected to formulate and articulate opinions on a range of issues, orally and in print. We will discuss the ethics of research in writing, the use of traditional resources as well as electronic tools, and ways of integrating these materials for professional-quality reports and essays. Much of our class time will be devoted to discussion of the readings and films, along with workshop sessions during which we will critique student work and explore techniques that make for powerful, interesting, persuasive, and provocative communication.

**ENGCOMP 0515 – Persuasive Writing (3 credits)** - In this course students will analyze and create the kinds of persuasive writing used in the fields of fundraising and advertising. Both types of writing attempt to influence the decisions people make about the money they spend, the attitudes they have, and the issues that shape our society.

**GEOL 0040 – Physical Geology (3 credits)** This class and its associated laboratory (GEOL 0055) are required for geology majors and recommended for civil and petroleum engineering students, and other science and engineering majors needing an introductory course in geology. The aim is to provide students with the fundamentals of geology. Topics covered are: (1) the description and origin of earth materials (minerals and rocks), (2) internal processes (i.e. volcanoes, earthquakes), (3) surface processes (i.e. erosion, deposition), (4) structural features of the earth, (5) resources.

**GEOL 0800 Geology (3 credits)** Geology is the study of how the Earth works. This class covers the classification and origin of basic rocks and minerals; examines the role of plate tectonics in shaping the Earth and producing such hazards as earthquakes and volcanoes; and examines the forces that shape beaches and rivers and sometimes threaten our lives and property. We also survey the evidence for changing climate and the future of such resources as groundwater, fossil fuels, and ores.

**GEOL 0860 Environmental Geology (3 credits)**

This course takes an integrated Earth systems approach to understanding our planet and its resources. We will investigate geologic processes and hazards (e.g., earthquakes, volcanoes, landslides, weather hazards), geologic resources (water, soil, minerals, energy) and the local and global ramifications of human interaction with the Earth (e.g., air, soil and water pollution, ozone depletion, and climate change). GEOL 0860 also serves as an introductory course for three majors in the Department of Geology and Planetary Science.

**GEOL 1445 GIS, GPS, and Computer Methods (3 credits)** The goal of this course is to gain expertise in the methods of Geographic Information Systems using the GeoTRANS and ArcGIS software packages on PC based workstations. No previous computer classes are required. Students will be graded on the basis of approximately 5 computer assignments, in-class exercises, a project, and final exam. This course is a core course for the GIS Certificate.

**PHIL 0300 Introduction to Ethics (3 credits)** This is a course considering the question of one fundamental principle, right and wrong. The results are applied to moral problems of serious interest today.