UNIVERSITY OF PITTSBURGH

Mechanical Engineering

Undergraduate Academic Program Manual

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Forward

This *Mechanical Engineering Undergraduate Academic Program Manual* is a supplement to the information provided in the Swanson School of Engineering's Undergraduate Catalog, which is the official source of information about the School's academic programs and degree requirements. It is provided so that you will be better informed about your department and for your convenience in monitoring progress towards completion of your degree. The latest version of this manual can be found on the MEMS Department's Student Resources webpage.

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Chapter 1

Undergraduate Program Description

1.1 Undergraduate Program Rationale

The breadth and diversity of the mechanical engineering profession requires an undergraduate curriculum that provides a solid foundation in the basic sciences, computational skills including the use of the latest sophisticated software tools, and the fundamentals of engineering and engineering design. The curriculum provides a base for future professional growth and is also an excellent background for those who wish to pursue careers in other professions, such as management, law, or medicine. The educational objective is to graduate students with excellent technical capabilities in the mechanical engineering discipline and related fields, who will be responsible citizens and continue their professional advancement through life-long learning.

In their career and professional activities, we expect our graduates to (a) demonstrate successful application of mechanical engineering knowledge and skills for industry, public sector organizations, or their profession, (b) pursue life-long learning through advanced professional degrees, graduate studies in engineering, professional training, or engineering certification, and (c) demonstrate professional and intellectual growth as leaders in their profession and/or community.

1.2 Mechanical Engineering Curriculum

The requirements for obtaining a Bachelor of Science (B.S.) degree in Mechanical Engineering are described below. Refer to the MEMS Department's Student Resources webpage or Appendix C to see one possible 4-year, semester-by-semester sequence through the curriculum. Mechanical engineering students can monitor their own progression through the curriculum using the **ME Curriculum Checklist** in Appendix A, which is also available on the Student Resources webpage.

Minors, Certificates, and Dual Degrees

We encourage our students to take full advantage of University of Pittsburgh resources and educational opportunities. Many of our students obtain Minors and/or Certificates that add value to their education and distinguish them as they move forward in their careers. Some of our students also seek a Dual Degree that augments the mechanical engineering experience—sometimes another engineering degree, sometimes a degree in Arts & Sciences. For additional information, please refer to the MEMS Department's Undergraduate Degree Options webpage.

1.2.1 Required Mathematics (5 Courses)

We require that students master basic mathematical skills in analytic geometry, calculus, linear algebra, and differential equations as preparation for mastery of mechanical engineering applications. The required math courses are:

- MATH 0220 Analytic Geometry & Calculus 1 (4 credits)
- MATH 0230 Analytic Geometry & Calculus 2 (4 credits)
- MATH 0240 Analytic Geometry & Calculus 3 (4 credits)
- Linear Algebra:
  - MATH 0280 Introduction to Matrices & Linear Algebra (3 credits), or
  - MATH 1180 Linear Algebra 1 (3 credits), or
  - MATH 1185 Honors Linear Algebra (3 credits)
- Differential Equations:
  - MATH 0290 Differential Equations (3 credits), or
  - MATH 1270 Ordinary Differential Equations 1 (3 credits)

Students interested in a **Math Minor** should consider taking MATH 1270 instead of MATH 0290 and either MATH 1180 or MATH 1185 instead of MATH 0280. Current MATH course descriptions can be found at PeopleSoft Mobile.

1.2.2 Required Basic Sciences (4 Courses, 1 Lab)

Engineering practice is frequently described as *applied science*. Mechanical engineers require knowledge of and ability to use basic physics and chemistry. The required basic sciences courses are:

- Two semesters of introductory chemistry
  - First semester:
    * CHEM 0110 General Chemistry 1 (4 credits), or
    * CHEM 0410 General Chemistry 1 (3 credits), or
    * CHEM 0710 Honors General Chemistry 1 (4 credits), or
    * CHEM 0760 Honors General Chemistry for Engineers 1 (3 credits), or

    * CHEM 0960 General Chemistry for Engineers 1 (3 credits)
  - Second semester:
    * CHEM 0120 General Chemistry 2 (4 credits), or
    * CHEM 0420 General Chemistry 2 (3 credits), or
    * CHEM 0720 Honors General Chemistry 2 (4 credits), or
    * CHEM 0770 Honors General Chemistry for Engineers 2 (3 credits), or
    * CHEM 0970 General Chemistry for Engineers 2 (3 credits)

  Note: the CHEM 0410/CHEM 0420 sequence also requires CHEM 0430 General Chemistry 1 Laboratory (1 credits).

- Two semesters of calculus-based physics
  - First semester:
    * PHYS 0174 Basic Physics for Science & Engineering 1 (4 credits), or
    * PHYS 0475 Honors Physics 1 (4 credits)
  - Second semester:
    * PHYS 0175 Basic Physics for Science & Engineering 2 (4 credits), or
    * PHYS 0476 Honors Physics 2 (4 credits)

Current PHYS and CHEM course descriptions can be found at PeopleSoft Mobile.

1.2.3 Required Humanities and Social Sciences (6 Courses)

The Swanson School of Engineering (SSoE) requires all undergraduates to complete **at least six** humanities and social science (H/SS) elective courses that adhere to the SSoE Guidelines and Requirements in order to satisfy SSoE and ABET accreditation requirements for breadth and depth. Please make sure that you adhere to the requirements for **breadth** and **depth**.

While only approved humanities and social sciences courses can be used to satisfy the H/SS requirements, the approved list is not static. New courses are added frequently. Students may petition the Senior Associate Dean for Academic Affairs to have a course added to the list of approved courses by submitting an **Approval Request for Humanities/Social Science Elective** form, available on the MEMS Department's Student Resources webpage. The form must be turned in to the Senior Associate Dean for Academic Affairs Office (147 Benedum Hall) for approval. Students can contact the Undergraduate Program Office approximately one week later to see if the course was approved. It is helpful to include a copy of a course description for the course. Courses that are deemed sufficiently relevant and academically appropriate generally are approved. Broad survey courses (typically below the 100 level that are generally taught in large lecture sections) are usually not approved.

Notes and Restrictions on Selecting Courses

- Transfer students may be required to take ENGCMP 0200 Seminar in Composition. This does not count as one of the six required elective courses.

- No more than two of the six required elective courses can be satisfied via advanced standing credit from AP exam scores.
- Courses that are cross-listed with other departments may be taken under either course number (e.g., ANTH 1524 is equivalent to HAA 1650) and may be used to satisfy the depth requirement in either department.
- Students are strongly encouraged to use language courses to partially satisfy the humanities and social science elective requirements. Three out of five, or six out of ten first-year language course credits are acceptable toward fulfilling the humanities and social science elective requirements. However, the following restrictions apply:
  - The language(s) must be other than English.
  - The language(s) must be other than the student's mother tongue.
  - The course(s) must be a bona fide language course.
- Dietrich School of Arts & Sciences (DSAS) courses cross-listed with College of General Studies (CGS) courses that are designated as self-paced (self), online (www), or hybrid online (hybrid) **or not** acceptable for fulfilling the H/SS requirements.

Current course descriptions for H/SS courses can be found at PeopleSoft Mobile.

1.2.4 Required Communication Skills (1 Course)

To satisfy the Communication Skills Elective requirement, students must satisfactorily complete one of the following courses. Note that a course can either be used as a Humanities and Social Sciences Elective or as the Communication Skills Elective, but not both. The Communication Skills Elective should be taken as soon as possible, in order that a student might benefit from it in other courses.

- COMMRC 0500 Argument (3 credits)
- COMMRC 0520 Public Speaking (3 credits)
- COMMRC 0540 Discussion (3 credits)
- ENGCMP 0400 Written Professional Communication (3 credits)
- ENGCMP 0401 Written Professional Communication: Topic in Diversity (3 credits)
- ENGCMP 0412 Engineering Communication in a Professional Context (3 credits)
- ENGCMP 0600 Introduction to Technical Writing (3 credits)
- ENGR 1010 Communication Skills for Engineers (3 credits)

1.2.5 Writing Requirement

All Swanson School of Engineering students must complete at least one writing intensive course (referred to from now on as a W-course), as certified by the Dietrich School of Arts and Sciences. When viewing the Class Detail for courses online, W-courses are distinguished by having **Writing Requirement Course** listed as one of their Class Attributes. Only courses that have this Class Attribute can be used to satisfy the writing requirement.

- Students should refer to **PeopleSoft** (in the **Class Search** screen, choose **Writing Option** from the **Requirement Designation** field) each term to determine whether a course is being offered as a W-designated course (i.e., courses with the **Writing Requirement Course** attribute). Note that there are courses that may have a writing option, but not for all of their sections.

- The writing requirement will normally be fulfilled by ensuring that either one of the six required Humanities and Social Sciences Electives or the Communications Skills Elective is a W-course. It will not typically require a student to take an additional course.

- ENGCMP 0200 Seminar in Composition is *not* a W-course and does not satisfy the writing requirement.

1.2.6 Required Basic Engineering (5 Courses)

The required basic engineering courses are:

- Freshman Engineering, first semester:

  - ENGR 0011 Introduction to Engineering Analysis (3 credits), or
  - ENGR 0015 Introduction to Engineering Analysis (3 credits), or
  - ENGR 0711 Honors Engineering Analysis and Computing (3 credits)

  Note: Transfer students can substitute any engineering course for the first semester Freshman Engineering requirement.

- Freshman Engineering, second semester:

  - ENGR 0012 Introduction to Engineering Computing (3 credits), or
  - ENGR 0016 Introduction to Engineering Computing (3 credits), or
  - ENGR 0712 Advanced Engineering Applications for Freshmen (Honors) (3 credits), or
  - ENGR 0716 Art of Hands-On System Design and Engineering (Art of Making) (3 credits)

  Note: Students who take ENGR 0016 must also take ENGCMP 0200 Seminar in Composition (3 credits).

- ENGR 0022 Materials Structure & Properties (3 credits)
  An introduction to the basic concepts of materials science and engineering. The concepts of atomic, crystal, micro- and macrostructure; and their control and effects on chemical, electrical, magnetic, optical, and mechanical properties. Modification of properties by heat treatment and control of processing. Fundamental considerations in materials selection. Prerequisites: MATH 0230, PHYS 0174.

- ENGR 0135 Statics & Mechanics of Materials 1 (3 credits)
  First of a two course sequence covering statics and mechanics 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. Prerequisites: MATH 0230, PHYS 0174.

- ENGR 0145 Statics & Mechanics of Materials 2 (3 credits)
  Second of a two course sequence covering statics and mechanics of materials. Topics include: flexure; second moment of areas, shear force and bending moment diagrams, composite beams, shearing stresses, beam deflections, energy methods, combined static loading, and buckling of columns. Prerequisite: ENGR 0135.

1.2.7 Required Core Mechanical Engineering (12 Courses)

The required core mechanical engineering courses are:

- MEMS 0024 Introduction to Mechanical Engineering Design (3 credits)
  Fundamentals of the design process, basic techniques of graphic communication, and an introduction to the most common mechanical components and manufacturing processes. Prerequisite: ENGR 0011.

- MEMS 0031 Electrical Circuits (3 credits)
  Fundamental laws, principles, and analysis techniques for DC and AC linear circuits whose elements consist of passive and active components used in modern engineering practice, including the determination of steady-state and transient responses. Prerequisite: PHYS 0175. Co-requisite: MATH 0290.

- MEMS 0040 Materials & Manufacturing (3 credits)
  Manufacturing and processing of ceramics, semiconductors, metals, and polymers covering refining, product formation, and control of properties. Prerequisite: ENGR 0022.

- MEMS 0051 Introduction to Thermodynamics (3 credits)
  Principles of classical thermodynamics; thermodynamic properties of simple substances, property tables, equations of state and ideal gases; first law of thermodynamics; second law of thermodynamics; thermodynamic functions and relationships; chemical reacting systems; phase equilibrium of one-component systems. Prerequisites: PHYS 0174, CHEM 0960. Co-requisite: MATH 0290.

- MEMS 0071 Introduction to Fluid Mechanics (3 credits)
Fundamental of fluid mechanics, with emphasis on inviscid and linearly viscous, incompressible fluids. Basic physical phenomena of fluid mechanics. Fluid kinematics. Governing equations (both integral and local forms). Exact solutions. Internal flows. Dimensional analysis and modeling. Prerequisites: PHYS 0174, CHEM 0960. 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, MEMS 0031, MEMS 1015.

- MEMS 1015 Rigid-Body Dynamics (3 credits)
Dynamics of particles, systems of particles, and rigid bodies including energy and momentum methods, problems of varying forces and constraints, and relationship of motion to different reference frames. Prerequisites: MATH 0240, ENGR 0135.

- MEMS 1028 Mechanical Design 1 (3 credits)
Stress and deflection analysis; survey of mechanical design criteria; selection and application of working stresses for ductile and brittle materials; static, fatigue, and impact loading and combination of stresses. Prerequisite: ENGR 0145.

- MEMS 1029 Mechanical Design 2 (3 credits)
Design and selection of various machine components including bearings, belts, gears, chains, screws, brakes, clutches, shafts and springs. Emphasis is placed on how these components are incorporated into various machines. Case studies, laboratory mini-projects and an open ended design project are also included. Prerequisites: MEMS 0024, MEMS 1028.

- MEMS 1041 Mechanical Measurements 1 (3 credits)
Fundamentals of mechanical measurements, including steady-state and dynamic signals, detector-transducer elements, signal conditioning and readout systems, standards, instrument calibration, statistical treatment of data, error analysis, and technical report writing. Prerequisites: ENGR 0145, MEMS 0031. Co-requisite: MEMS 1014.

- MEMS 1042 Mechanical Measurements 2 (3 credits)
Builds on the foundation of mechanical measurements provided in MEMS 1041 to provide students with the ability to properly design and perform an experiment on a complex mechanical system in order to determine specific characteristics or performance of that system. Specific material includes extended knowledge of statistics and error analysis, computer-based data acquisition, and technical communications. Prerequisite: MEMS 1041.

- MEMS 1052 Heat & Mass Transfer (3 credits)
One- and two-dimensional steady- and unsteady-state heat conduction; internal and external forced convection; free convection; engineering principle of radiation; heat exchangers and special topics. Prerequisite: MEMS 0051.

- MEMS 1085 Departmental Seminar (0 credits)
  Seminars are designed to acquaint the student with aspects of mechanical engineering not normally encountered in classes and include a wide range of topics such as the significance of engineering as a profession and the relation of engineering to current social problems.

1.2.8 Required Capstone Design Project (1 Course)

Students are required to satisfactorily complete the following capstone design project course:

- MEMS 1043 Senior Design Project (3 credits)
  A major project involving literature search, planning, design, fabrication, experimentation, analysis, technical report, poster presentation, and presentation at a technical symposium is performed by a small team of students under the direction of a faculty advisor and corporate advisor on a project presented by the corporate advisor. Prerequisite: *senior standing*.

If a student has successfully completed the requirements for the Innovation, Product Design and Entrepreneurship Certificate, then ENGR 1050 Product Realization can be used in place of MEMS 1043 as the required capstone design project course. In this case, ENGR 1050 would not count as one of the required elective courses.

1.2.9 Required ME Technical Electives (5 Courses)

Students are required to satisfactorily complete five Mechanical Engineering Technical Elective courses. A current list of approved ME Technical Electives is available on the MEMS Department's Student Resources webpage. The courses are listed below by general subject area, to assist students who wish to choose courses from an area of personal interest (note that some courses are listed under more than one subject area). Current course descriptions for these courses can be found at PeopleSoft Mobile.

- **Note:** at least one of the five technical electives must be from the Dynamics Systems subject area.

- After completing three co-op rotations and submitting a Co-op Report, the three credits of ENGR 1090 may be counted as a ME Technical Elective.

- Included is a selection of 2000-level (i.e., Masters-level) courses that students may use to satisfy the technical elective requirements.

- Courses offered by other engineering departments that are not part of another engineering program's freshman or sophomore curriculum may be approved as ME Technical Electives. See the list of approved ME Technical Electives for the current list of such courses.

Technical Electives by Subject Area

- **Dynamic Systems**
  MEMS 1020 Mechanical Vibrations
  MEMS 1045 Automatic Controls
  MEMS 1049 Mechatronics
  MEMS 1082 Electromechanical Sensors and Actuators
  ME 2027 Advanced Dynamics
  ME 2045 Linear Control Systems
  ME 2046 Digital Control Systems

- **Engineering Mathematics & Computation**
  MEMS 1047 Finite Element Analysis
  MEMS 1120 Applied Engineering Simulation in Design
  ME 2001 Differential Equations
  ME 2002 Linear and Complex Analysis
  ME 2060 Numerical Methods

- **Fluid/Thermal Systems**
  MEMS 1051 Applied Thermodynamics
  MEMS 1065 Thermal Systems Design
  MEMS 1071 Applied Fluid Mechanics
  ME 2003 Introduction to Continuum Mechanics
  ME 2056 Introduction to Combustion Theory

- **Materials Science & Engineering**
  MEMS 1010 Experimental Methods in Materials Science & Engineering
  MEMS 1011 Structures & Properties Laboratory
  MEMS 1030 Material Selection in Mechanical Design
  MEMS 1053 Structure of Crystals & Diffraction
  MEMS 1058 Electromagnetic Properties of Materials
  MEMS 1059 Phase Equilibria in Multi-Component Materials
  MEMS 1063 Phase Transformations & Microstructure Evolution
  MEMS 1070 Mechanical Behavior of Materials
  MEMS 1101 Ferrous Physical Metallurgy
  MEMS 1102 Principles & Applications of Steel Alloy Design
  MEMS 1103 Principles & Applications of Steel Processing & Design
  MEMS 1163 Ceramic Materials

- **Manufacturing**
  MEMS 1030 Material Selection in Mechanical Design
  MEMS 1033 Fracture Mechanics for Manufacturing & Performance
  MEMS 1045 Automatic Controls
  MEMS 1047 Finite Element Analysis
  MEMS 1049 Mechatronics
  MEMS 1057 Micro/Nano Manufacturing

- **Nuclear Engineering**
  ENGR 1700 Introduction to Nuclear Engineering
  ENGR 1701 Fundamentals of Nuclear Reactors
  ENGR 1702 Nuclear Plant Technology

- **Solid Mechanics**
  MEMS 1030 Material Selection in Mechanical Design
  MEMS 1033 Fracture Mechanics for Manufacturing & Performance
  MEMS 1047 Finite Element Analysis
  ME 2003 Introduction to Continuum Mechanics
  ME 2022 Applied Solid Mechanics

1.2.10 Required Engineering Elective (1 Course)

Students are required to complete one Engineering Elective course. Any course offered within the Swanson School of Engineering may be used to satisfy this requirement, provided only that it does not substantially replicate another course in a student's curriculum. A current list of approved Engineering Electives is available on the MEMS Department's Student Resources webpage.

- In contrast to the requirements for a ME Technical Elective, the Engineering Elective *can* be from another engineering program's sophomore curriculum (i.e., it does not have to be an "upper-level" course).

- A sixth ME Technical Elective may be used to fulfill this requirement.

1.2.11 Required Open Elective (1 Course)

Any course that is **not** of a similar nature to, or lower level than, a required or previously taken course can be used to fulfill the requirement.

- Three credits of physical education or three credits of band, ROTC, or chorus may be used to fulfill the Open Elective requirement.

- A second Engineering Elective or a sixth ME Technical Elective may be used to fulfill this requirement.

- Examples of courses that **may not** be used to fulfill the Open Elective requirement include:

  - ENGCMP 0200 Seminar in Composition
  - Any MATH course below MATH 0220 Analytic Geometry & Calculus 1
  - Any PHYS course below PHYS 0174 Physics for Science & Engineering 1

1.3 Advanced Standing and Transfer Credit

Students transferring into the Mechanical Engineering and Materials Science Department from other colleges and universities will have their academic records reviewed for advanced standing after they have been accepted for admission. Advanced standing for a University of Pittsburgh course means that a student receives transfer credit for that course. Only the credits will transfer for the course, not the grade received at the previous institution, but in all other respects it as if the student took the course at the University of Pittsburgh.

The determination of advanced standing is made by the MEMS Undergraduate Director, in accordance with Swanson School of Engineering policy and criteria established by the Accreditation Board for Engineering and Technology (ABET).

- Only courses in which the applicant received a grade of at least 2.00 on a 4.00 scale will be considered for advanced standing, and then only if the course can be used to satisfy degree requirements.
- Advanced standing for engineering or engineering science courses will be given only if the courses were taken from an ABET accredited engineering program.
- Advanced standing for mathematics and science courses will be awarded to the extent that those courses match Dietrich School of Arts and Sciences courses.
- Humanities and social science courses must either correspond to those on the Swanson School of Engineering's approved list of humanities and social science electives or meet the Swanson School of Engineering's requirements for an acceptable humanities and social science elective, as determined by the Undergraduate Director.
- A maximum of 96 transfer credits may be applied towards the degree (75% of the 128 credits required for graduation).

Students transferring from either an institution maintaining a 3/2 program with the Swanson School of Engineering or a community college having an articulation agreement with the school will receive advanced standing in accordance with those agreements.

Advanced Placement (AP) Credit

The Swanson School of Engineering encourages students to take advantage of college prep courses offered at their high schools. This allows students to start ahead in the freshman curriculum and can create openings in future terms, which can be used for courses toward a minor or dual degree. We do, however, caution students that core courses such as Calculus, Chemistry, and Physics are building blocks for future success, and so credit should only be used if a student is truly confident in their retention of the material. Please see the freshman engineering web page (https://www.engineering.pitt.edu/freshman) for the current Swanson School of Engineering policy relating AP scores with advanced standing credit.

Transfer Credit for Courses Taken After Enrollment

Students enrolled in the Swanson School of Engineering may take courses at other universities to satisfy graduation requirements only if those courses are approved in advance by the Undergraduate Director. Students residing in the Pittsburgh area are expected to take all of their courses at the University of Pittsburgh, unless there is a special course offered at one of the other area four-year colleges that is not available at the University of Pittsburgh. See Section 1.3.1 for more information on cross-registering at PCHE-member institutions. Students may take courses at the Greensburg and Johnstown campuses of the University of Pittsburgh. Engineering and engineering science courses must have been taken from an ABET-approved engineering program.

Only the credits will transfer for the equivalent class, not the grade or grade point average, and credit will only be given if the student receives at least 2.0 on a 4.0 scale. It is the student's responsibility to have their transcript sent to the Undergraduate Office, 636 Benedum Hall, at the completion of the class.

1.3.1 PCHE Cross-Registration

Cross-college and cross-university registration is a program designed to provide for enriched educational opportunities for undergraduates at any of the ten institutions that comprise the Pittsburgh Council on Higher Education (PCHE): Carnegie Mellon, Carlow College, Chatham College, Community College of Allegheny County, Duquesne University, Point Park College, LaRoche College, Robert Morris College, Pittsburgh Theological Seminary, and the University of Pittsburgh. Under the terms of this program, full-time students at any one of these institutions are granted the opportunity to enroll for a maximum of six credits per term at any of the other institutions. Each institution provides the others with lists of those courses approved by department chairpersons as being open to cross-registration. Such courses must be selected from those regularly accredited toward baccalaureate programs, and a student registering for them must meet all prerequisites. Priority in registration goes to the students of the host college. Credits and grades are transferred.

The following limitations apply:

- Cross-registration is available only during the Fall and Spring Terms.
- Undergraduates and post-baccalaureate students must be registered for a total of at least 12 credits (including the cross-registration credits).
- Students may not cross-register for courses available at the home institution.
- Students cannot use cross-registration to repeat courses taken at the University of Pittsburgh.
- Once a student is enrolled in the Mechanical Engineering and Materials Science Department, he/she is not permitted to take courses at the Community College of Allegheny County or any other two-year institution as part of his/her engineering education.
- Students may not use cross-registration to take courses that are not acceptable for an Engineering degree.

- The grading system for a cross-registered course is determined by the college or university that offers the course. The student must also follow that school's procedures and deadlines for add/drop, etc.

Cross-registration takes place during the add/drop period, ending the last day of the University of Pittsburgh's add/drop period. Interested students should go to the Engineering Office of Administration, 151 Benedum Hall, for a PCHE registration form and additional instructions.

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Cross-registration takes place during the add/drop period, ending the last day of the University of Pittsburgh's add/drop period. Interested students should go to the Engineering Office of Administration, 151 Benedum Hall, for a PCHE registration form and additional instructions.

1.4 Undergraduate Resources Web Page

A variety of resources is available on the Undergraduate/Student Resources page of the department's website. Here you will find:

- The latest versions of this Academic Program Manual, the Curriculum Checklist, the Schedule of Course Offerings by Term, etc.
- Semester course schedules.
- Departmental information regarding co-op participants, the departmental seminar, graduation, humanities and social science electives, etc.
- Various university forms for Anticipated Graduation Date, Graduation Application, Permission to register for more than 18 credits, etc.

Chapter 2

Academic Policy

2.1 Grading System

The University of Pittsburgh uses a standard letter grade system, as described below. All of the courses taken for fulfillment of the requirements for a Bachelor of Science in Engineering must be taken with the Letter Grade Option—the H/S/U and S/NC grade options are not allowed. The only exception is for courses through University of Pittsburgh International Programs, which are taken pass/fail (S/U). The minimum grade for satisfactory completion of a course is a "D−."

2.1.1 Letter Grades and Grade Points

The University's letter grades and their associated grade points are as follows:

Grades		**Grade Points**
A+	=	4.00
A	=	4.00 Superior
A−	=	3.75
B+	=	3.25
B	=	3.00 Meritorious
B−	=	2.75
C+	=	2.25
C	=	2.00 Adequate
C−	=	1.75
D+	=	1.25
D	=	1.00 Minimal
D−	=	0.75
F	=	0.00 Failure

2.1.2 Other Grades: Incomplete, Withdrawn, Resigned

Upon a student's completion of a course, one of the grades listed below may appear on the student's transcript in lieu of the letter grades discussed above.

- A "G" grade signifies unfinished course work due to extenuating circumstances. Students assigned "G" grades are required to complete course requirements within the next term of registration or within the time specified by the instructor. The instructor of the course will complete a grade change authorization form and send it to the School of Engineering Office of Administration for processing. If a "G" grade is not removed within one year, the instructor may change it to an "F" grade for the course.

- An "I" grade signifies incomplete course work due to the nature of the course, clinical work, or incomplete research work in individual guidance courses or seminars. It is not typically used for undergraduates.

- A "R" grade signifies that a student resigned from the University.

- A "W" grade signifies that a student has withdrawn from a course (see Withdrawal below).

2.2 Withdrawal

To receive a refund, a student must officially drop a course during the term's add/drop period. Through the ninth week of the term, a student may withdraw from a course by completing a Monitored Withdrawal form available in the Undergraduate Program Office. The course instructor must sign the form. Withdrawal forms for courses offered by the Swanson School of Engineering must be processed through the Engineering Office of Administration. Withdrawal forms for courses offered by the Dietrich School of Arts and Sciences must be processed through that school's dean's office. A "W" grade will then be assigned for the course. Withdrawal from a course after the ninth week of the term is permitted only for extremely extenuating circumstances. It requires the approval of the Associate Dean for Academic affairs.

2.3 Calculation of the Grade Point Average

Each credit carried for a letter grade is awarded grade points as shown in the table above. A student's term grade point average (term GPA) is the total grade points earned for the term divided by the total credits assigned letter grades. A student's cumulative grade point average (cumulative GPA) is determined by dividing the total number of grade points by the total number of credits assigned letter grades. Only credits that are taken at the University of Pittsburgh are used in the calculation of the grade point averages.

2.3.1 Course Repeats

If a student receives a grade of "C−" or lower in a course, repeats the course within one calendar year, and receives a better grade the second time, then the second grade will replace the previously assigned grade when calculating the cumulative GPA.

- The time limit can be extended if a student is not able to repeat a course within one calendar year due to extenuating circumstances (e.g., the course was only offered when the student was on a co-op rotation). Such an extension must be approved by the Associate Dean for Academic Affairs.

- No sequence course may be repeated for credit after a higher-numbered sequence course has been satisfactorily completed with a "C" or better.

- Students are only permitted to repeat a course twice. For the purposes of this rule, grades of "R" or "W" do not count as repeats. If a student receives a better grade the third time, then that grade will replace the two previously assigned grades when calculating the cumulative GPA. Special permission from the Associate Dean for Academic Affairs is required to take a course for a fourth time and will granted only for extremely extenuating circumstances.

- Grades for courses that have been repeated will remain on a student's transcript, even if they are not used in determining the GPA.

2.4 Academic Honors

At the end of each term, the academic records of all undergraduate degree students in the School of Engineering are reviewed to determine eligibility for the Term Honor List and the Dean's Honor List. Students who qualify for both honor lists will appear only on the Dean's Honor List.

2.4.1 Term Honor List

To be eligible for the Term Honor List, a student must have (1) earned a term grade point average of at least 3.25, (2) completed a minimum of 15 credits of academic work for letter grades at the University of Pittsburgh, and (3) completed a minimum of six credits of work for letter grades in the term of eligibility.

2.4.2 Dean's Honor List

To be eligible for the Dean's Honor List, a student must have (1) earned cumulative and term grade point averages of at least 3.25, (2) completed a minimum of 30 credits of academic work for letter grades at the University of Pittsburgh, and (3) completed a minimum of six credits of work for letter grades in the term of eligibility.

2.5 Academic Discipline

To be considered in good academic standing, a student's cumulative GPA must be at least 2.00 and the student must be making satisfactory progress toward earning an engineering degree. Each engineering student's academic record is reviewed at the end of each term.

2.5.1 Warning

If a student's *term* GPA is less than 2.00, but his/her *cumulative* GPA is still greater than or equal to 2.00, then the student will receive a warning letter from the School of Engineering that he/she is in academic difficulty, which could eventually lead to probation if academic performance does not improve. The student is still in good academic standing.

2.5.2 Probation

A student whose *cumulative* GPA drops below 2.00 is no longer in good academic standing and will be placed on academic probation. A student is subject to suspension or dismissal if his/her cumulative GPA remains below 2.00 for two consecutive terms.

2.5.3 Suspension

After being suspended, students are not eligible to reenroll for one calendar year, after which they are required to apply for reinstatement through the Swanson School of Engineering Office of Administration. Students returning from academic suspension are reinstated on academic probation and their academic performance will be reviewed after each subsequent term. If the student's cumulative GPA remains below 2.00 for two consecutive terms, he/she will be subject to dismissal.

2.5.4 Dismissal

Dismissal is a final action. Dismissed students are not eligible for future enrollment in the Swanson School of Engineering.

2.6 Reinstatement

An engineering student in good academic standing who has not attended the University of Pittsburgh for three consecutive terms, and has attended no other institution in the intervening period, will be considered for reinstatement after making an application to the Undergraduate Director. If the student has attended another institution and completed more than 12 credits, then the student must reapply through the University's Office of Admission and Financial Aid in accordance with the procedure for transfer applicants from other colleges or universities.

2.7 Graduation Requirements

In order to graduate with a Bachelor of Science in Engineering in the Mechanical Engineering program:

1. A student must have satisfactorily completed all required courses, as defined in Chapter 1, for a total of at least 128 credits.
   (a) All of the courses taken for fulfillment of the degree requirements must be taken with the Letter Grade Option. The only exception is for courses through University of Pittsburgh International Programs, which are taken pass/fail (S/U).
   (b) Advanced standing credit accepted by the Swanson School of Engineering may partially fulfill degree requirements, up to a maximum of 96 credits.
   (c) Only credits approved by the Mechanical Engineering and Materials Science Undergraduate Director count towards the 128-credit requirement.
   (d) No course in which an "F" or a non-letter grade was received can be used to satisfy the 128-credit requirement. A minimum "D−" letter grade is required.
2. A student must have a cumulative GPA of at least 2.00.
3. The work of the senior year (a minimum of 26 credits) must be completed while in residence at the Swanson School of Engineering. Exceptions to this regulation may be granted for a limited number of credits through petition to the department.

Students must complete an Application for Graduation form in the term that they are graduating. This form is available in the Undergraduate Program Office and on the Undergraduate/Student Resources page of the department's website. After completing the form, students turn it in to the Engineering Office of Administration. Students should pay attention to the application deadlines to avoid late fees. The deadlines are posted online.

- It is suggested that students schedule an appointment with their advisor to review their records in the term preceding the term in which they plan to graduate, in order to make sure everything is in order. It is the students' responsibility to meet all of the department's requirements for graduation.
- During the add/drop period of the term that a student is planning to graduate, students must notify the MEMS Department's Undergraduate Academic Administrator. The MEMS Undergraduate Director will then review each student's records and communicate to the student what needs to be done in order to complete his/her graduation requirements. It is important that this happens during the add/drop period, in case there are any changes required to a student's academic schedule.

To be considered for honors at graduation, a student must earn at least 68 letter grade credits at the University of Pittsburgh. The minimum cumulative GPA for graduation cum laude is 3.25, for magna cum laude is 3.50, and for summa cum laude is 3.75.

2.7.1 Statute of Limitations

All required academic work for the Bachelor of Science degree in Engineering, including courses for which advanced-standing credit has been granted, must be completed within 12 consecutive calendar years. Under unusual circumstances a student may, with the approval of the Undergraduate Director, request a waiver of this policy.

Chapter 3

Degree Options

Brief descriptions of some of the degree options available to students in the Mechanical Engineering and Materials Science Department are given below. More information, including links to specific web sites for each of the degree options listed below, is available online at `https://www.engineering.pitt.edu/mems`.

3.1 Cooperative Education Program

The Cooperative Education (Co-op) Program at Pitt is one of the most exciting opportunities available to engineering students. By alternating work and school terms, the co-op program provides students with relevant, challenging, paid work assignments with local, national, or international employers.

The program integrates a rotation of school and employment terms that enables the cooperative education student to complement his or her formal classroom training with additional technical knowledge, hands-on experience, and financial remuneration. The co-op graduate possesses the maturity and assurance of a more seasoned employee and the ability to incorporate academic knowledge and theory into practice. During co-op rotations, students earn competitive salaries, which makes this program also financially rewarding.

Mechanical Engineering and Materials Science students have the option of using their co-op credits (ENGR 1090) towards one of the technical electives in the curriculum, provided that a technical paper is submitted to the department. The guidelines and due dates for the co-op paper are available on the Undergraduate/Student Resources page of the department's website.

The co-op option is available to all engineering undergraduates. Students must be in good academic standing (minimum 2.00 GPA) and must be eligible to complete a minimum of three work terms. Most students begin during the sophomore year and complete the program during the senior year. Students who are interested in participating in the co-op program should contact the Cooperative Education Program Office, located on the first floor of Benedum Hall.

3.2 Engineering Minors

Undergraduate students in the Mechanical Engineering and Materials Science department can choose to enhance their education by minoring in another engineering area of interest. Each of the departments in the School of Engineering offers at least one minor. Descriptions of these minors and their requirements are available online.

3.3 Arts and Sciences Minors

Many departmental minors are available in programs offered by the Dietrich School of Arts and Sciences, including architectural studies, computer science, economics, history, mathematics, and physics. Students must complete at least half of the credits earned for a minor at the University of Pittsburgh and must complete a minor with at least a 2.00 GPA.

3.4 Certificate Programs

Swanson School of Engineering undergraduate students are encouraged to broaden their educational experience by electing to take one of the certificate programs currently offered by the Dietrich School of Arts and Sciences, the University Center for International Studies, and the Swanson School of Engineering. Typically, the certificate programs may be used by engineering students to partially fulfill the humanities/social sciences or technical elective requirements, thereby allowing specialization in an area of interest while pursuing an engineering degree. The requirements for each certificate vary, and students should contact the appropriate certificate program director.

The Swanson School of Engineering offers thirteen certificates at the undergraduate level:

- Civil Engineering and Architectural Studies
- Conceptual Foundations of Medicine
- Energy Resource Utilization
- Engineering for Humanity
- Engineering Simulation
- Fessenden Honors Engineering
- Health Systems Engineering
- Innovation, Product Design, and Entrepreneurship
- International Engineering Studies
- NanoScience and Engineering
- Nuclear Engineering

- Supply Chain Management
- Sustainable Engineering

3.5 Arts and Sciences-Engineering Joint Degree Program

The Dietrich School of Arts and Sciences and the Swanson School of Engineering have developed an undergraduate joint degree program that permits students to combine a major in arts and sciences with a program in engineering and then receive degrees from both the Dietrich School of Arts and Sciences and the Swanson School of Engineering. Students can apply for admission into the program through either the Dietrich School of Arts and Sciences or the Swanson School of Engineering and must be admitted into both schools.

3.6 Engineering-School of Education Certification Program

Engineering students may apply for a fifth-year program that leads to mathematics, general science, or physics teaching certification from the School of Education. Students who complete the program are qualified to teach in the Commonwealth of Pennsylvania. Students interested in pursuing this option should apply prior to the start of their junior year.

3.7 University Honors College

The University Honors College is something of a paradox: Though headquartered in a newly renovated suite at the University of Pittsburgh's Cathedral of Learning, it's not really a bricks-and-mortar school within the University. And although UHC offers specific courses and the bachelor of philosophy degree, the options are available to any student (in any major) who demonstrates an extraordinary ability to pursue independent scholarship.

3.8 Emerging Leaders Program

Emerging Leaders introduces participants to four fundamentals of leadership; self-knowledge, valuing others, personal accountability, and integrity. Learners explore these topics while building skills in group dynamics, conflict management, power and influence, diversity, ethics, and life-work planning. This 10-week program provides learners with opportunities to:

- Explore and assess your leadership skills and style.
- Practice and experiment with new leadership behavior.
- Receive feedback on your style and behavior.
- Plan for your on-going leadership development.

3.9 International Education

The Swanson School of Engineering is making a concerted effort to expand students' knowledge through international education. As the world becomes increasingly interconnected and globalization is a way of life, engineering students must understand how to operate in a global manner to remain competitive. The school's programs provide opportunities for students to broaden their horizons in numerous ways.

3.10 Receiving Graduate Credit

An undergraduate student who intends to continue towards an advanced degree may arrange to schedule a limited number of courses for graduate credit during the next to the last term or final term of registration for the B.S. degree. Approval will be granted only if the student's total program for the term does not exceed 18 credits. A maximum of 6 credits can be applied to a master's degree program. These credits will only apply to graduate degree requirements.

3.11 Combined Liberal Arts & Engineering 3/2 Programs with Other Colleges and Universities

The Swanson School of Engineering has developed combined liberal arts and engineering joint-degree programs with a number of accredited liberal arts colleges and universities. These programs are typically referred to as 3/2 programs, since the student initially enrolls at the liberal arts institution, completing a three-year structured program. Those first three years usually include the general education requirements for the liberal arts degree, specific courses in areas of concentration required for all engineering programs, and the courses necessary for acceptance to the Swanson School of Engineering. With the recommendation of the review committee at the liberal arts institution, the student then applies for transfer to the Swanson School of Engineering. If accepted, the student spends the final two years in the Mechanical Engineering program.

At the request of the student, his or her Swanson School of Engineering academic record will be forwarded to the liberal arts institution for evaluation, and a liberal arts degree will be awarded in accordance with the policy of the liberal arts institution. The engineering degree will be awarded upon completion of the engineering requirements.

Interested students should be referred to the Director of Freshman Programs for specific information and requirements. The 3/2 agreements and articulation agreements should be followed very closely. If students take courses that are not listed on the 3/2 agreement, the classes most likely will not transfer.

APPENDICES

Appendix A - ME Curriculum Checklist

Name: __________ **Date:** __________

Course	**Credits**	**Course Title**	**Prerequisites/Corequisites**
CHEM0960	3	Gen. Chem. for Engr. 1	
CHEM0970	3	Gen. Chem. for Engr. 2	CHEM0960
MATH0220	4	Anal. Geometry & Calc. 1	
MATH0230	4	Anal. Geometry & Calc. 2	MATH0220 (C or better)
MATH0240	4	Anal. Geometry & Calc. 3	MATH0230 (C or better)
MATH0280	3	Matrices & Linear Algebra	MATH0220
MATH0290	3	Differential Equations	MATH0230
PHYS0174	4	Phys. for Sci. & Engr. 1	*MATH0220*[1]
PHYS0175	4	Phys. for Sci. & Engr. 2	PHYS0174, *MATH0230*
	3	Humanity Elective	
	3	Social Science Elective	Student has fulfilled
	3	Humanity/Soc. Sci. Elective	☐ Breadth
	3	Humanity/Soc. Sci. Elective	☐ Depth
	3	Humanity/Soc. Sci. Elective	☐ W-course
	3	Humanity/Soc. Sci. Elective	
	3	Communication Skills Elective	
ENGR0011	3	Intro. to Engr. Analysis	
ENGR0012	3	Engr. Computing	ENGR0011
ENGR0022	3	Mater. Struct. & Properties	MATH0230, PHYS0174
ENGR0135	3	Statics & Mech. of Mater. 1	MATH0230, PHYS0174
ENGR0145	3	Statics & Mech. of Mater. 2	ENGR0135
	3	Open Elective	
	3	Engineering Elective	
MEMS0024	3	Intro. to ME Design	ENGR0011
MEMS0031	3	Electrical Circuits	PHYS0175, *MATH0290*
MEMS0040	3	Materials & Manufacturing	ENGR0022
MEMS0051	3	Intro. to Thermodynamics	PHYS0174, CHEM0960, *MATH0290*
MEMS0071	3	Intro. to Fluid Mechanics	PHYS0174, CHEM0960, *MATH0290*
MEMS1014	3	Dynamic Systems	MATH0280, ENGR0012, MEMS0031, MEMS1015
MEMS1015	3	Rigid-Body Dynamics	MATH0240, ENGR0135
MEMS1028	3	Mechanical Design 1	ENGR0145
MEMS1029	3	Mechanical Design 2	MEMS0024, MEMS1028
MEMS1041	3	Mechanical Measurements 1	ENGR0145, MEMS0031, *MEMS1014*
MEMS1042	3	Mechanical Measurements 2	MEMS1041
MEMS1043	3	Senior Design Project	*Senior Standing*
MEMS1052	3	Heat and Mass Transfer	MEMS0051
	3	ME Technical Elective	
	3	ME Technical Elective	
	3	ME Technical Elective	
	3	ME Technical Elective	
	3	Dynamic Systems Elective	MEMS1014

[1] Italicized courses indicate corequisites, that is, courses that must be taken before or concurrently.

Appendix B - ME Course Offerings by Term

To assist you in long term schedule planning, a term-by-term listing of course offerings is provided below. This schedule will be especially helpful to students who decide to enroll in the co-op program.

Course Number	**Fall Term**	**Spring Term**	**Summer Term**
ENGR0022	•	•	
ENGR0135	•	•	•
ENGR0145	•	•	•
Engr. Electives	•	•	•
MEMS0024	•		
MEMS0031		•	•
MEMS0040		•	•
MEMS0051		•	•
MEMS0071	•	•	
MEMS1014	•	•	
MEMS1015		•	•
MEMS1028	•	•	
MEMS1029		•	•
MEMS1041	•	•	
MEMS1042	•	•	•
MEMS1043	•	•	•
MEMS1052	•		•
MEMS1085	•	•	
Tech. Electives	•	•	
Dyn. Sys. Elec.	•	•	•

- Note that, in general, Mechanical Engineering Technical Electives are only offered during the Fall and Spring Terms. However, MEMS 1049 Mechatronics is offered in the Summer Term.
- This is a tentative schedule that is subject to change. However, changes will not be made without appropriate accommodation for students' existing plans.

Appendix C - ME Sample Schedule

Shown below is an example of a schedule of courses that leads to a B.S. in Mechanical Engineering in four years. It satisfies all of the relevant course prerequisites and the Mechanical Engineering degree requirements.

FIRST TERM

Subject		**Credits**
CHEM0960	Gen. Chem. for Engr. 1	3
MATH0220	Anal. Geometry & Calc. 1	4
PHYS0174	Phys. for Sci. & Engr. 1	4
ENGR0011	Intro. to Engr. Analysis	3
	Humanity/Soc. Sci. Elective	3
ENGR0081	Freshman Seminar	0
		17

SECOND TERM

Subject		**Credits**
CHEM0970	Gen. Chem. for Engr. 2	3
MATH0230	Anal. Geometry & Calc. 2	4
PHYS0175	Phys. for Sci. & Engr. 2	4
ENGR0012	Engr. Computing	3
	Communication Skills Elective	3
ENGR0082	Freshman Seminar	0
		17

THIRD TERM

Subject		**Credits**
MATH0240	Anal. Geometry & Calc. 3	4
MATH0280	Matrices & Linear Algebra	3
ENGR0022	Mater. Struct. & Properties	3
ENGR0135	Statics & Mech. Mater. 1	3
MEMS0024	Intro. to ME Design	3
MEMS1085	Departmental Seminar	0
		16

FOURTH TERM

Subject		**Credits**
MATH0290	Differential Equations	3
ENGR0145	Statics & Mech. Mater. 2	3
MEMS0031	Electrical Circuits	3
MEMS0051	Intro. to Thermodynamics	3
MEMS1015	Rigid-Body Dynamics	3
	Humanity/Soc. Sci. Elective	3
MEMS1085	Departmental Seminar	0
		18

FIFTH TERM

Subject		**Credits**
MEMS0071	Intro. to Fluid Mechanics	3
MEMS1014	Dynamic Systems	3
MEMS1028	Mechanical Design 1	3
	Open Elective	3
	Humanity/Soc. Sci. Elective	3
MEMS1085	Departmental Seminar	0
		15

SIXTH TERM

Subject		**Credits**
MEMS0040	Materials & Manufacturing	3
MEMS1029	Mechanical Design 2	3
MEMS1041	Mechanical Measurements 1	3
	Engineering Elective	3
	Humanity/Soc. Sci. Elective	3
MEMS1085	Departmental Seminar	0
		15

SEVENTH TERM

Subject		**Credits**
MEMS1042	Mechanical Measurements 2	3
MEMS1052	Heat and Mass Transfer	3
	ME Technical Elective	3
	Dynamic Systems Elective	3
	Humanity/Soc. Sci. Elective	3
MEMS1085	Departmental Seminar	0
		15

EIGHTH TERM

Subject		**Credits**
MEMS1043	Senior Design Project	3
	ME Technical Elective	3
	ME Technical Elective	3
	ME Technical Elective	3
	Humanity/Soc. Sci. Elective	3
MEMS1085	Departmental Seminar	0
		15

Appendix D - Co-op Schedule Form

Student Name: ______________________________
Department: ________________________________
Anticipated Co-op Start Date: ________________

Current Status (circle one): Sophomore 2 Junior 1 Junior 2 Senior 1

	Fall	*Spring*	*Summer*
Year 1			
Year 2			
Year 3			
Year 4			
Year 5			

Co-op Advisor's Signature: ____________________________ Date: ______________
Student's Signature: ________________________________ Date: ______________

Any changes in scheduling *must* be approved by your faculty advisor. The co-op office will not be responsible for students who deviate from their schedules without departmental approval.

Appendix E - ME Co-op Schedule A

Student Name: ____________________
Department: ____________________
Anticipated Co-op Start Date: ____________

Current Status (circle one): Sophomore 2 Junior 1 Junior 2 Senior 1

	Fall	*Spring*	*Summer*
Year 1	CHEM0960 MATH0220 PHYS0174 ENGR0011 *Soc. Sci./Hum.*	CHEM0970 MATH0230 PHYS0175 ENGR0012 *Comm. Skills*	
Year 2	MATH0240 MATH0280 ENGR0022 ENGR0135 MEMS0024	MATH0290 ENGR0145 MEMS0031 MEMS0051 MEMS1015	
Year 3	MEMS0071 MEMS1014 MEMS1028 *Soc. Sci./Hum.* *Soc. Sci./Hum.*	**Work Rotation**	**Work Rotation**
Year 4	MEMS1041 MEMS1052 *Engr. Elec.* *Open Elec.* *Soc. Sci./Hum.*	MEMS0040 MEMS1029 MEMS1042 *ME Tech. Elec.* *ME Tech. Elec.*	**Work Rotation**
Year 5	**Work Rotation**	MEMS1043 *ME Tech. Elec.* *Dyn. Sys. Elec.* *Soc. Sci./Hum.* *Soc. Sci./Hum.*	

Co-op Advisor's Signature: ____________________ Date: __________
Student's Signature: ____________________ Date: __________

Any changes in scheduling *must* be approved by your faculty advisor. The co-op office will not be responsible for students who deviate from their schedules without departmental approval.

Appendix F - ME Co-op Schedule B

Student Name: ____________________
Department: ____________________
Anticipated Co-op Start Date: ____________

Current Status (circle one): Sophomore 2 Junior 1 Junior 2 Senior 1

	Fall	*Spring*	*Summer*
Year 1	CHEM0960 MATH0220 PHYS0174 ENGR0011 *Soc. Sci./Hum.*	CHEM0970 MATH0230 PHYS0175 ENGR0012 *Comm. Skills*	
Year 2	MATH0240 MATH0280 ENGR0022 ENGR0135 MEMS0024	MATH0290 ENGR0145 MEMS0031 MEMS0051 MEMS1015	**Work Rotation**
Year 3	**Work Rotation**	MEMS0071 MEMS1014 MEMS1028 MEMS1041 *Soc. Sci./Hum.*	MEMS0040 MEMS1029 MEMS1042 MEMS1052 *Soc. Sci./Hum.*
Year 4	*ME Tech. Elec.* *Dyn. Sys. Elec.* *Engr. Elec.* *Open Elec.* *Soc. Sci./Hum.*	**Work Rotation**	**Work Rotation**
Year 5	MEMS1043 *ME Tech. Elec.* *ME Tech. Elec.* *Soc. Sci./Hum.* *Soc. Sci./Hum.*		

Co-op Advisor's Signature: ____________________ Date: __________
Student's Signature: ____________________ Date: __________

Any changes in scheduling *must* be approved by your faculty advisor. The co-op office will not be responsible for students who deviate from their schedules without departmental approval.

Appendix G - ME Co-op Schedule C

Student Name: ______________________________
Department: ________________________________
Anticipated Co-op Start Date: ________________

Current Status (circle one): Sophomore 2 Junior 1 Junior 2 Senior 1

	Fall	*Spring*	*Summer*
Year 1	CHEM0960 MATH0220 PHYS0174 ENGR0011 *Soc. Sci./Hum.*	CHEM0970 MATH0230 PHYS0175 ENGR0012 *Comm. Skills*	
Year 2	MATH0240 MATH0280 ENGR0022 ENGR0135 MEMS0024	MATH0290 ENGR0145 MEMS0031 MEMS0051 MEMS1015	**Work Rotation**
Year 3	**Work Rotation**	MEMS0071 MEMS1014 MEMS1028 *Open Elec.* *Soc. Sci./Hum.*	**Work Rotation**
Year 4	**Work Rotation**	MEMS1029 MEMS1041 *ME Tech. Elec.* *ME Tech. Elec.* *Soc. Sci./Hum.*	MEMS0040 MEMS1042 MEMS1052 *Soc. Sci./Hum.* *Soc. Sci./Hum.*
Year 5	MEMS1043 *ME Tech. Elec.* *Dyn. Sys. Elec.* *Engr. Elec.* *Soc. Sci./Hum.*		

Co-op Advisor's Signature: ______________________________ Date: ______________
Student's Signature: ___________________________________ Date: ______________

Any changes in scheduling *must* be approved by your faculty advisor. The co-op office will not be responsible for students who deviate from their schedules without departmental approval.