UMSL/Washington University Joint Undergraduate Engineering Program

General Information
The Joint Undergraduate Engineering Program of UMSL and Washington University was approved in 1993 by the University of Missouri and the Coordinating Board for Higher Education. The program is designed to offer course work beyond the pre-engineering courses at UMSL and the area community colleges. Pre-engineering and general education courses are offered at UMSL, and upper-level engineering courses are offered in the late afternoons, evenings and on Saturdays on the Washington University campus; this schedule permits students to co-op during the day at local engineering firms. Students will be admitted to the upper-division program only after they have completed an acceptable pre-engineering program. They can earn a bachelor of science in civil engineering (B.S.C.E.), a bachelor of science in electrical engineering (B.S.E.E.), or a bachelor of science in mechanical engineering (B.S.M.E.).

Mission Statement
The mission of the University of Missouri-St. Louis/Washington University Joint Undergraduate Engineering Program is to provide a high quality civil, mechanical, and electrical engineering education leading to a well-trained, sophisticated work force primarily for the St. Louis region. The program strives to excite and nurture the intellectual, technical, professional and personal development of the students through a partnership which provides a mechanism for Washington University to share its campus, resources and personnel with the UMSL students, many of whom are place-bound individuals. The Joint Program reflects the commitment of both institutions to work together to provide for the civil, mechanical and electrical engineering needs of the St. Louis community.

Program Educational Objectives
The University of Missouri-St. Louis/Washington University Joint Undergraduate Engineering Program aspires to make positive, substantive and lasting contributions to the lives of our students. The nontraditional and traditional students in the civil, mechanical and electrical engineering programs often have work experience in or related to engineering practice. The program seeks to impart an education that inspires the graduates to constantly share their knowledge with others, to continually improve their knowledge and understanding, and to persistently adapt to change in technology and world needs. Graduates of the program are expected to develop and use professional skills that facilitate their continued career growth well beyond their graduation and should be able to apply their comprehensive education within the civil, mechanical and electrical engineering profession or a related field. The objectives are to:

• Meet the needs of employers of civil, mechanical, and electrical engineers, with an emphasis on the St. Louis region.
• Meet the expectations of graduate schools that our alumni attend.

Career Outlook
Engineering is one of the few careers in which the bachelor’s degree is a professional degree. Students earning a bachelor of science degree in one of the engineering disciplines are well qualified for entry-level engineering positions in a variety of businesses, industries, consulting firms, and government agencies. As society becomes increasingly dependent on technology, the outlook for all engineering disciplines becomes increasingly bright. Engineering careers typically rank at, or very near, the top of virtually any published rating of promising jobs for the 21st Century. Besides tackling challenging technical problems, roughly two-thirds of all engineers will have some level of management responsibility within ten years of receiving their bachelor’s degrees. Many practicing engineers will eventually continue their education by pursuing graduate...
degrees on a part-time basis. Typical areas of graduate study include all advanced technical and scientific fields and management.

For Further Information
For information about enrolling in this program, please contact the UMSL/Washington University Joint Undergraduate Engineering Program at 314-516-6800.

Degree Requirements
- Bachelor of Science in Civil Engineering
- Bachelor of Science in Electrical Engineering
- Bachelor of Science in Mechanical Engineering

A program of 132 semester hours is required for the Bachelor of Science in Civil Engineering, a program of 122 semester hours is required for the Bachelor of Science in Electrical Engineering, and a program of 134 semester hours is required for the Bachelor of Science in Mechanical Engineering, as shown below:

- All majors must complete the University General Education requirements (http://bulletin.umsl.edu/generaleducationrequirements), the Pre-Engineering Requirements and the Core Engineering Requirements.
- All students must first complete J E MATH 3170, Engineering Mathematics, with a minimum grade of C-.
- Mechanical and Electrical Engineering majors must also complete J E ENGR 2300, Introduction to Electrical Networks with a minimum grade of C-.
- A minimum grade of C- is necessary to meet the prerequisite requirement for any course.

Pre-Engineering Requirements
Students seeking to major in engineering are first designated as 'Undeclared with an interest in Engineering majors' until they have completed Math 1800 Analytical Geometry & Calculus I. Upon successful completion of Math 1800 with a grade of C or better, students will be allowed to declare pre-engineering as their major. Math 1800 must be completed successfully within two attempts.

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
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<tbody>
<tr>
<td>MATH 1800</td>
<td>5</td>
</tr>
<tr>
<td>MATH 1900</td>
<td>5</td>
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<tr>
<td>MATH 2000</td>
<td>5</td>
</tr>
<tr>
<td>MATH 2020</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 1111</td>
<td>5</td>
</tr>
<tr>
<td>PHYSICS 2111</td>
<td>5</td>
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<tr>
<td>PHYSICS 2121</td>
<td>5</td>
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<tr>
<td>ENGR 2310</td>
<td>3</td>
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<tr>
<td>ENGR 2320</td>
<td>3</td>
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<tr>
<td>ENGL 1100</td>
<td>3</td>
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<tr>
<td>Total Hours</td>
<td>42</td>
</tr>
</tbody>
</table>

Civil engineering majors must also complete GEOL 1001A, General Geology as part of the pre-engineering requirements (3 Hours).

General Education Requirements
- PHIL 2259 Engineering Ethics 3
- PHIL 3380 Philosophy Of Science 3

Engineering Core Requirements

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>CMP SCI 1250</td>
<td>Introduction To Computing</td>
<td>3</td>
</tr>
<tr>
<td>J E COMM 2000</td>
<td>Engineering Studio I</td>
<td>1</td>
</tr>
<tr>
<td>J E MATH 3170</td>
<td>Engineering Mathematics</td>
<td>4</td>
</tr>
<tr>
<td>ENGL 3130</td>
<td>Technical Writing</td>
<td>3</td>
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<tr>
<td>Total Hours</td>
<td></td>
<td>11</td>
</tr>
</tbody>
</table>

Electrical And Electronic Circuits Laboratory

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>J C ENGR 4200</td>
<td>Soil Exploration And Testing</td>
<td>1</td>
</tr>
<tr>
<td>J C ENGR 4600</td>
<td>Highway and Traffic Engineering</td>
<td>3</td>
</tr>
<tr>
<td>J C ENGR 4640</td>
<td>Foundation Engineering</td>
<td>3</td>
</tr>
<tr>
<td>J C ENGR 4670</td>
<td>Structure Design Projects</td>
<td>3</td>
</tr>
<tr>
<td>J C ENGR 4910</td>
<td>Hydraulic Engineering</td>
<td>3</td>
</tr>
<tr>
<td>J C ENGR 4940</td>
<td>Water Hydrology and Hydraulic Design Project</td>
<td>3</td>
</tr>
<tr>
<td>J C ENGR 4970</td>
<td>Construction Operations And Management</td>
<td>3</td>
</tr>
<tr>
<td>J C ENGR 4974</td>
<td>Economic Decisions In Engineering</td>
<td>3</td>
</tr>
<tr>
<td>J C ENGR 4990</td>
<td>Senior Civil Engineering Seminar</td>
<td>1</td>
</tr>
<tr>
<td>J M ENGR 1413</td>
<td>Introduction To Engineering Design: CAD</td>
<td>2</td>
</tr>
<tr>
<td>J M ENGR 2410</td>
<td>Mechanics Of Deformable Bodies</td>
<td>3</td>
</tr>
<tr>
<td>J M ENGR 3360</td>
<td>Material Science For J C ENGR</td>
<td>3</td>
</tr>
<tr>
<td>J M ENGR 3700</td>
<td>Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>J M ENGR 3721</td>
<td>Fluid Mechanics Laboratory</td>
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</tr>
<tr>
<td>MATH 1320</td>
<td>Applied Statistics I</td>
<td>3</td>
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<tr>
<td>Civil Engineering Electives</td>
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<td>6</td>
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<tr>
<td>Total Hours</td>
<td></td>
<td>58</td>
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</table>
and 4000 level that include sufficient engineering design and engineering science content to produce the required totals. Transfer courses from other institutions do not necessarily have the same engineering science and engineering design content as their equivalents in the UMSL/Washington University Joint Undergraduate Engineering Program. Students who include transfer courses in their curricula should consult with their advisers to be sure that these requirements are met.

**Graduation Requirements**

In addition to the requirements of the University of Missouri-St. Louis that apply to all candidates for undergraduate degrees, the student must earn a minimum campus grade point average of 2.0 and a minimum grade point average of 2.0 for all engineering courses attempted at the University of Missouri-St. Louis.

**Latin Honors Requirements**

In accordance with the University’s Latin Honors policy (http://bulletin.umsl.edu/undergraduatestudy/#academicrecognitontext), candidates graduating from the University of Missouri St. Louis/Washington University Join Undergraduate Engineering Program in the 2016-2017 Academic Year must meet the following GPA qualifications:

- Summa Cum Laude: 3.925
- Magna Cum Laude: 3.780
- Cum Laude: 3.536

**Sample Four Year Plans**

BS Electrical Engineering (p. 3)  BS Civil Engineering (p. 4)  BS Mechanical Engineering (p. 4)

**Electrical Engineering**

### First Year

**Fall**

- MATH 1800 5 3
- CHEM 1111 5 3
- ENGL 1100 3 3
- ENGR 1010 1 3

<table>
<thead>
<tr>
<th>Hours</th>
<th>Fall</th>
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<tbody>
<tr>
<td>14</td>
<td>14</td>
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</table>

**Second Year**

**Fall**

- General Education 3 3
- PHIL 2259 3 3
- PHYSICS 2111 5 5
- MATH 2000 5 3

<table>
<thead>
<tr>
<th>Hours</th>
<th>Fall</th>
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<tbody>
<tr>
<td>16</td>
<td>17</td>
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<table>
<thead>
<tr>
<th>Hours</th>
<th>Summer</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>3</td>
<td>3 ENGR 2320</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>PHIL 3380</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>PHYSICS 2112</td>
<td></td>
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<tr>
<td>3</td>
<td>MATH 2020</td>
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</table>

<table>
<thead>
<tr>
<th>Hours</th>
<th>Third Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
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<tr>
<td>3</td>
<td>3</td>
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<tr>
<td>3</td>
<td>3</td>
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</tbody>
</table>

**Third Year**

**Fall**

- J E ENGR 2300 3 3
- J E ENGR 3300 3 3
- J E ENGR 3510 3 3
- J CMP SC 1002 1 3
- CMP SCI 1250 3 3
- ENGL 3130 3 3
- J E MATH 3170 3 3

<table>
<thead>
<tr>
<th>Hours</th>
<th>Fall</th>
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<tbody>
<tr>
<td>14</td>
<td>12</td>
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</tbody>
</table>

**Fourth Year**

**Fall**

- J E ENGR 4410 3 6

**Engineering Design and Engineering Science Requirements**

The number of semester hours assigned to each engineering course in the Joint Undergraduate Engineering Program is further divided into hours of engineering design, engineering science, and basic science content. Engineering topics is the sum of engineering science hours and engineering design hours. The following table shows the design hours and engineering science hours for courses in the engineering programs.

Each engineering student must complete a curriculum that contains at least 48 hours of engineering topics semester hours, including all courses: pre-engineering requirements, engineering core requirements, major requirements, and electives. Civil, electrical, and mechanical engineering majors should consult with their advisers to select electives at the 3000
PLEASE NOTE: This plan is an example of what a four-year plan could look like for a typical student. Placement exam scores in math as well as the completion of coursework may change the plan. It should not be used in the place of regular academic advising appointments. All students are encouraged to meet with their advisor each semester. All requirements are subject to change.

## Civil Engineering

<table>
<thead>
<tr>
<th>First Year</th>
<th>Hours</th>
<th>Fall</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1800</td>
<td>1</td>
<td>5</td>
<td>HIST 1001 or 1002</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 1111</td>
<td>3</td>
<td>5</td>
<td>General Education</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 1100</td>
<td>3</td>
<td>3</td>
<td>GEOL 1001A</td>
<td>4</td>
</tr>
<tr>
<td>ENGR 1010</td>
<td>1</td>
<td>MATH 1900</td>
<td>5</td>
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<td></td>
<td>14</td>
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</tbody>
</table>

**Total Hours: 126**

**PLEASE NOTE:** This plan is an example of what a four-year plan could look like for a typical student. Placement exam scores in math as well as the completion of coursework may change the plan. It should not be used in the place of regular academic advising appointments. All students are encouraged to meet with their advisor each semester. All requirements are subject to change.

## Mechanical Engineering

<table>
<thead>
<tr>
<th>First Year</th>
<th>Hours</th>
<th>Fall</th>
<th>Spring</th>
<th>Summer</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1800</td>
<td>1</td>
<td>5</td>
<td>HIST 1001 or 1002</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CHEM 1111</td>
<td>3</td>
<td>5</td>
<td>MATH 1900</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>ENGL 1100</td>
<td>3</td>
<td>3</td>
<td>General Education</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>ENGR 1010</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
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<td>14</td>
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</tbody>
</table>

**Total Hours: 140**

**PLEASE NOTE:** This plan is an example of what a four-year plan could look like for a typical student. Placement exam scores in math as well as the completion of coursework may change the plan. It should not be used in the place of regular academic advising appointments. All students are encouraged to meet with their advisor each semester. All requirements are subject to change.
Engineering Courses

ENGR 1010 Introduction to Engineering: 1 semester hour
This course, required of all new Freshman with an Interest in Engineering, is designed to assist students in their transition to the university experience and to UMSL by giving students the knowledge and tools needed to succeed as scholars. Students will learn about faculty expectations, support services, and student life, as well as engineering.

ENGR 2310 Statics: 3 semester hours
Prerequisites: MATH 1900 and PHYSICS 2111. Statics of particles and rigid bodies. Equivalent systems of forces. Distributed forces; centroids. Applications to trusses, frames, machines, beams, and cables. Friction. Moments of inertia. Principle of virtual work and applications.

ENGR 2320 Dynamics: 3 semester hours

Joint Civil Engineering Courses

J C ENGR 2160 Surveying: 3 semester hours
Horizontal and vertical control surveys, including traverses, triangulation, trilateration, and leveling; basic adjustments of observations; geologic data; coordinate systems. Basic route surveying, including horizontal and vertical curves.

J C ENGR 3360 Civil Engineering Materials Lab: 1 semester hour

J C ENGR 3410 Structural Analysis: 3 semester hours

J C ENGR 3420 Structural Design: 3 semester hours
Prerequisites: J M ENGR 3250, J C ENGR 3410. Fundamentals of structural design in steel, reinforced concrete, and timber. Familiarization with the sources of various design codes and practice in interpreting them. Computer graphics applications.

J C ENGR 3460 Transportation Engineering: 3 semester hours
Fundamental treatment of the planning, engineering, design, and procedural aspects of multimodal transportation are covered. Intermodal freight and urban transportation planning processes and overview of environmental, energy, and economic issues are discussed.

J C ENGR 3760 Hydraulic Engineering: 3 semester hours
Prerequisites: J M ENGR 3700. The principles of open channel flow will be discussed and illustrated with practical examples. Methods for channel design, storm sewer, culvert and bridge analysis will be presented using the concepts of gradually-varied, steady flow. A design project using computerized analysis and design is used to implement concepts in a large practical application.

J C ENGR 4000 Independent Study: 1-6 semester hours
Prerequisites: Junior standing and consent of faculty advisor. Independent investigation of a civil engineering topic of special interest to a student performed under the direction of a faculty member.

J C ENGR 4190 Soil Mechanics: 3 semester hours

J C ENGR 4200 Soil Exploration And Testing: 1 semester hour
Prerequisite: J C ENGR 4190 (may be taken concurrently). Soil exploration; in-situ soil testing; laboratory testing of soil; processing of test data using a microcomputer; statistical analysis of test data; use of test results in the decision-making process.

J C ENGR 4600 Highway and Traffic Engineering: 3 semester hours

J C ENGR 4621 Traffic Operations and Analysis: 3 semester hours
Prerequisites: Senior Standing. Study of traffic system operations and analysis, microsimulation modeling, interchange types, and the fundamentals of highway signing and marking. Introduction into transportation analysis project management. Analysis and design techniques focus on microsimulation modeling and the Manual of Uniform Traffic Control Devices. Material learned is integrated into a major design project.

J C ENGR 4630 Design Of Steel Structures: 3 semester hours
Prerequisites: J C ENGR 3410, J C ENGR 3420. Behavior and design of steel frames by “allowable stress” and “maximum strength” based on deterministic and LRFD (Load-resistance factor design) methods. Design of beams, columns, beamcolumns, plate girders, connections, multistory frames, and bridge girders. Torsional design of steel structures. Plastic analysis and design of steel structures. Miscellaneous topics in structural steel construction and design.

J C ENGR 4640 Foundation Engineering: 3 semester hours
Prerequisites: J C ENGR 3420, J C ENGR 4190, J C ENGR 4200. Principal problems in design and construction of foundations for bridges and buildings. Bearing capacity of deep and shallow foundations; pressure on retaining walls and shallow foundations; pressure on retaining walls and slope stability; modern developments in piling, cofferdams, open caissons, pneumatic caissons.

J C ENGR 4660 Advanced Design Of Concrete Structures: 3 semester hours
Prerequisites: J M ENGR 3250, J C ENGR 3410, J C ENGR 3420. Flexural behavior and design, strength and deformation of rectangular and nonrectangular sections, shear strength, beamcolumns, long columns, slab systems, design of frames, and footings will be covered.
J C ENGR 4670 Structure Design Projects: 3 semester hours
Prerequisite: Permission of instructor. Students carry out the complete
design of typical and unusual building and bridge structures. Use of the
computer as a design tool is emphasized. Projects are conducted in
cooperation with production engineers.

J C ENGR 4720 Legal Aspects Of Construction: 3 semester hours
Prerequisite: Junior standing or permission of instructor. A survey of
the legal problems of the construction manager. Including but limited to,
liability in the areas of contracts, agency, torts, insurance, bad judgement
and oversight.

J C ENGR 4730 Construction Operations And Management: 3 semester hours
Prerequisite: Junior standing. The construction industry, its development,
components, and organization. Contracting methods. Applications and
limitations. Selection of equipment using production analysis
and economics. Field engineering, including form design, shoring,
embankment design. Purchasing and change orders. Safety and claims.

J C ENGR 4740 Economic Decisions In Engineering: 3 semester hours
Prerequisite: Junior standing. Principles of economics involved in
engineering decisions. Decisions between alternatives based on the
efficient allocation of resources. Topics include the time element in
economics, analytical techniques for economy studies, and taxes.

J C ENGR 4830 Fundamentals of Surface Water Hydrology and
Environmental Engineering: 3 semester hours
Prerequisites: Fluid Mechanics and senior status. The principles of
the hydrologic cycle including precipitation, evaporation, transpiration,
infiltration, runoff, streamflow, and groundwater will be discussed and
illustrated. In addition, computational fundamentals of hydrologic analysis
will be presented such as unit hydrographs, routing, data analysis, and
flood frequency. Elements of quantitative problems in urban stormwater
systems and management, water quality and urbanization. Concepts of
sustainability and green engineering such as low impact development and
other best management practices will be presented. Computer software
will be utilized.

J C ENGR 4910 Water Hydrology and Hydraulic Design Project: 3 semester hours
Prerequisites: J M ENGR 3700, J C ENGR 3760, and J C ENGR 4830.
This course is designed to provide seniors in Hydrology and Hydraulics
with a major design/facility plan project. The principals of hydrologic and
hydraulic design will be utilized in developing the hydrology, hydraulics
and floodplain analysis for a local watershed or land area. Hydrologic
analysis is performed to size hydraulic systems and evaluate watershed
and floodplain performance. The course is structured to apply hydrologic
typical and modeling techniques to engineering hydrology and hydraulics
for watershed analysis, floodplain delineation, and urban stormwater. The
student will also consider the next generation of hydrologic computation,
watershed evaluation and the importance of severe storm impacts and
flood management. Consideration of sustainability and green infrastructure
practices will also be included. A final written report and class presentation
of the design project is included.

J C ENGR 4950 Fundamentals Of Engineering Review: 1 semester hour
Prerequisite: Senior Standing. A review and preparation of the most
recent NCEES Fundamentals of Engineering (FE) Exam specifications
is offered in a classroom setting. Exam strategies will be illustrated
using examples. The main topics for the review include engineering
mathematics, statics, dynamics, fluids, heat transfer, mechanics of
materials, hydraulics, transportation, environmental engineering, structural
design and geotechnical engineering. A discussion of the importance and
responsibilities of professional engineering licensure along with ethics will
be included.

J C ENGR 4990 Senior Civil Engineering Seminar: 1 semester hour
Prerequisite: Senior standing. Students will research assigned topics of
importance to graduates entering the Civil Engineering profession and
prepare oral presentations and a written report. Student presentations will
be augmented by lectures from practicing professionals. Topics include
professional registration, early career development, graduate study,
effective presentations, construction quality, and case histories of civil
engineering projects.

Joint Computer Science Courses
J CMP SC 1002 Introduction To Computing Tools: Matlab Skills: 1 semester hour
This course is aimed at the acquisition of MATLAB skills through hands-
on familiarization and practice. Students practice the array, vector, and
meshgrid representations, programming and plotting, and apply these
skills to solve numerical problems and generate reports. (J CMP SC 1002
and CMP SCI 1250 can substitute for J CMP SC 1360).

Joint Electrical Engineering Courses
J E ENGR 2300 Introduction To Electrical Networks: 3 semester hours
Elements, sources, and interconnects. Ohm's and Kirchoff's laws,
superposition and Thevenin's theorem; the resistive circuit, transient
analysis, sinusoidal analysis, and frequency response.

J E ENGR 2320 Introduction To Electronic Circuits: 3 semester hours
Prerequisites: J E ENGR 2300. Introduction to contemporary electronic
deVICES and their circuit applications. Terminal characteristics of active
semiconductor devices. Incremental and D-C models of junction diodes,
bipolar transistor (BJTs), and metal-oxide semiconductor field effect
transistors (MOSFETs) are developed and used to design single-and
multi-stage amplifiers, Models of the BJT and MOSFET in cutoff and
saturation regions are used to design digital circuits.

J E ENGR 2330 Electrical And Electronic Circuits Laboratory: 3 semester hours
Prerequisites: J E ENGR 2300. Lectures and laboratory exercises related
to sophomore topics in introductory networks and basic electronics.

J E ENGR 2340 Electrical Laboratory for Mechanical Engineers: 1 semester hour
Prerequisites: J E ENGR 2300. Laboratory in introductory electrical circuits
and devices of relevance to mechanical engineers.

J E ENGR 2600 Introduction To Digital Logic And Computer Design: 3 semester hours
Prerequisite: J CMP SC 1260. Digital computers and digital information-
processing system; Boolean algebra, principles and methodology of
logical design; machine language programming; register transfer logic;
microprocessor hardware, software, and interfacing; fundamental of digital
circuits and systems; computer organization and control; memory systems;
arithmetic unit design. Occasional laboratory exercises.
J E ENGR 3300 Engineering Electromagnetic Principles: 3 semester hours
Electromagnetic theory as applied to electrical engineering; vector calculus; electrostatics and magnetostatics; Maxwell's equations, including Poynting's theorem and boundary conditions; uniform plane-wave propagation; transmission line-TEM modes, including treatment of general, lossless line, and pulse propagation; introduction to guided waves; introduction to radiation and scattering concepts.

J E ENGR 3310 Electronics Laboratory: 3 semester hours
Prerequisites: J E ENGR 2300, J E ENGR 2330. Laboratory exercises for juniors covering topics in computer-aided measurements, computer simulation, and electronic circuits.

J E ENGR 3320 Power, Energy And Polyphase Circuits: 3 semester hours
Prerequisite: J E ENGR 2300. Fundamental concepts of power and energy; electrical measurements; physical and electrical arrangement of electric power systems; polyphase circuit theory and calculations; principle elements of electrical systems such as transformers, rotating machines, control, and protective devices, their description and characteristics; elements of industrial power system design.

J E ENGR 3360 Principles Of Electronic Devices: 3 semester hours
Introduction to the solid-state physics of electronic materials and devices, including semiconductors, metals, insulators, diodes and transistors, Crystals growth technology and fundamental properties of crystals. Electronic properties and band structure of electronic materials, and electron transport in semiconductor materials. Fabrication of pn junction diodes, metal-semiconductor junctions, and transistors and integrated circuit chips. Fundamental electrical properties of rectifying diodes and light-emitting diodes, bipolar transistors and field effect transistors. Device physics of diodes and transistors, large-signal electrical behavior and high-frequency properties.

J E ENGR 3370 Electronic Devices And Circuits: 3 semester hours

J E ENGR 3510 Signals And Systems: 3 semester hours
Prerequisites: J E ENGR 2300 and J E MATH 3170. Elementary concepts of continuous-time and discrete-time signals and systems. Linear time-invariant (LTI) systems, impulse response, convolution, Fourier series, Fourier transforms, and frequency-domain analysis of LTI systems. Laplace transforms, Z-transforms, and rational function descriptions of LTI systems. Principles of sampling and modulation. Students participate weekly in recitation sections to develop oral communications skills using class materials.

J E ENGR 3620 Computer Architecture: 3 semester hours
Prerequisite: J E ENGR 2600. Study of interaction and design philosophy of hardware and software for digital computer systems: Machine organization, data structures, I/O considerations. Comparison of minicomputer architectures.

J E ENGR 4000 Independent Study: 1-3 semester hours
Prerequisites: Senior in Good Standing. Opportunities to acquire experience outside the classroom setting and to work closely with individual members of the faculty. A final report must be submitted to the department. Open as a senior elective only. Hours and credit to be arranged. Credit variable, maximum credit per semester 3 hours. Maximum program total credit 3 hours.

J E ENGR 4050 Reliability And Quality Control: 3 semester hours
Prerequisites: J E MATH 3260 or MATH 1320. An integrated analysis of reliability and quality control function in manufacturing. Statistical process control, analysis, reliability prediction, design, testing, failure analysis and prevention, maintainability, availability, and safety are discussed and related. Qualitative and quantitative aspects of statistical quality control and reliability are introduced in the context of manufacturing.

J E ENGR 4340 Solid State Power Circuits And Applications: 3 semester hours
Prerequisite: J E ENGR 2300, J E ENGR 3510. Study of the strategies and applications of power control using solid-state semiconductor devices. Survey of generic power electronic converters. Applications to power supplies, motor drives, and consumer electronics. Introduction to power diodes, thyristors, and MOSFETs.

J E ENGR 4350 Electrical Energy Laboratory: 3 semester hours
Prerequisites: J E ENGR 2300. Experimental studies of principles important in modern electrical energy systems. Topics: power measurement, transformers, batteries, static frequency converters, thermoelectric cooling, solar cells, electrical lighting, induction, commutator, and brushless motors, synchronous machines.

J E ENGR 4360 Energy Alternatives: 3 semester hours
Prerequisites: J E ENGR 2300, or J M ENGR 3200. This course introduces engineering analyses of the human uses of energy. Both non-renewable (e.g., oil, natural gas, coal, nuclear) and sustainable (e.g., hydropower, solar, wind, biomass) resources are covered. Topics include the engineer’s role in harvesting, production, storage, conversion, delivery, and uses of energy. Students will learn system analysis, design, integration, optimization, and operational aspects of selected resources delivery systems, and end uses. Technical content will include site selection, conversion and delivery efficiency calculations, engineering economic analyses, control systems, and energy resource systematic classification. Measure will consist of a mix of homework, quizzes, tests, class participation, and projects.

J E ENGR 4410 Control Systems I: 3 semester hours

J E ENGR 4520 Power Systems Analysis: 3 semester hours
Prerequisite: J E ENGR 3320. Introduction to the modeling and elements of power systems; machines, lines, and loads; load flow methods and applications; short circuit analysis using symmetrical components on symmetrical and asymmetrical faults; methods of economic operation of power systems and contingency; state estimators, stability, and introduction of the independent system operator.
Joint Mechanical Engineering Courses

**J M ENGR 1413 Introduction To Engineering Design: CAD:** 2 semester hours
An introduction to engineering design in the context of mechanical engineering. Students learn the fundamentals of spatial reasoning and graphical representation. Freehand sketching, including pictorial and orthographic views, are applied to the design process. Computer modeling techniques provide accuracy, analysis, and visualization tools necessary for the design of devices and machines. Topics in detailing design for production, including fasteners, dimensioning, tolerancing, and creation of part and assembly drawings are also included.

**J M ENGR 2410 Mechanics Of Deformable Bodies:** 3 semester hours

**J M ENGR 3010 Computer Aided Design:** 3 semester hours
Prerequisite: J M ENGR 1413. Computer aided design, analysis and optimization of parts and assemblies; solid modeling of complex surfaces, creation of detail drawings, dimensioning and tolerancing; assembly modeling, assembly constraints, interference checking; motion constraints, force and acceleration analysis, thermal analysis; part optimization for weight, strength and thermal characteristics using Unigraphics software.

**J M ENGR 3221 Mechanical Design And Machine Elements:** 4 semester hours
Prerequisites: J M ENGR 1414, J M ENGR 1415, J M ENGR 2410, J E MATH 3170. Provides a thorough overview of the steps in the engineering design process and introduces analytical/quantitative techniques applicable to each step. Topics include recognition of need, specification formulation, concept generation, concept selection, embodiment, and detail design. Includes an introduction to several classes of machine elements such as bearings, gears, belts, and springs. Underlying analytical model of the machine elements are presented along with guidelines about designing and choosing such elements for practical applications. A case study from industry will emphasize how the steps of the design process were done as well as the rational for choosing particular machine elements.

**J M ENGR 3250 Material Science For J M ENGR:** 4 semester hours
Prerequisites: CHEM 1111. Introduces the chemistry and physics of engineering materials. Emphasis on atomic and molecular interpretation of physical and chemical properties, the relationships between physical and chemical properties, and performance of an engineering material.
J M ENGR 3360 Material Science For J C ENGR: 3 semester hours
Same as J M ENGR 3250, but without the lab. Prerequisite: CHEM 1111. Introduces the chemistry and physics of engineering materials. Emphasis on atomic and molecular interpretation of physical a chemical properties, the relationships between physical and chemical properties, and performance of an engineering material.

J M ENGR 3700 Fluid Mechanics: 3 semester hours

J M ENGR 3710 Principles Of Heat Transfer: 3 semester hours

J M ENGR 3721 Fluid Mechanics Laboratory: 1 semester hour
Prerequisites: J M ENGR 3700. Physical laboratory exercises focusing on fluid properties and flow phenomena covered in J M ENGR 3700. Calibration and use of a variety of equipment; acquisition, processing, and analysis of data by manual as well as automated methods.

J M ENGR 3722 Heat Transfer Laboratory: 1 semester hour
Prerequisites: J M ENGR 3721 and J M ENGR 3710. Physical laboratory exercises, including some numerical simulations and computational exercises, focusing on heat-transfer phenomena covered in J M ENGR 3710. Calibration and use of variety of laboratory instrumentation; acquisition, processing, and analysis of data by manual as well as automated methods; training in formal report writing.

J M ENGR 3750 Fluid Control and Power Systems Theory And Practice: 3 semester hours
Prerequisite: J M ENGR 3700. Topics to be covered include: design of hydraulic and pneumatic control and power systems using advanced concepts and analytical tools; analysis of fluid flow through small orifices and between parallel and inclined planes; theory of spool and flapper valves; physical configuration of practical components: pumps, motors, fluid lines and valves, accumulators and storage devices; integration of components into practical systems, development of realistic performance diagrams using MATLAB Simulink; application of performanc diagrams in design and analysis of fluid power systems.

J M ENGR 4000 Independent Study: 3 semester hours
Prerequisites: Junior standing and consent of faculty advisor. Independent investigation of a mechanical engineering topic of special interest to a student performed under the direction of a faculty member.

J M ENGR 4041 Current Topics In Engineering Design: 1 semester hour
Case studies of engineering failures, class discussion & short written papers are used to illustrate and stress the importance of engineering teamwork, ethics, and professional standards within the mechanical engineering discipline. Working in teams students develop and present a case study on a topic of their choice. Guest lecturers introduce contemporary topics such as product liability, environmental regulations, green design, appropriate technologies, and concurrent engineering.

J M ENGR 4110 Mechanical Engineering Design Project: 4 semester hours
Prerequisites: J M ENGR 3221. Feasibility study of an open-ended, original design or a creative redesign of a mechanical component or system requiring the application of engineering science principles. Feasibility is subject to economic, safety, legal, environmental, ethical, aesthetic, and other constraints in a competitive manufacturing environment. Project teams perform the detailed design and optimization of the concept developed in the feasibility study. Presentations and reports with manufacturing drawings and prototypes are completed by each team.

J M ENGR 4120 Design of Thermal Systems: 3 semester hours
Prerequisites: Senior Standing. Analysis and design of advanced thermo-fluid systems. Student teams participate in the design process which could involve research, design formulation, codes, standards, engineering economics, a design project report, and formal presentations. Topics include: thermal-fluid systems and components, such as power, heating, and refrigeration systems, pumps, fans, compressors, combustors, turbines, nozzles, coils, heat exchangers and piping.

J M ENGR 4170 Dynamic Response Of Physical Systems: 2 semester hours

J M ENGR 4180 Dynamic Response Laboratory: 1 semester hour
PREREQUISITES: J M ENGR 4170 and J M ENGR 4180 must be taken during the same semester. Laboratory problems focusing on materials covered in J M ENGR 4170.

J M ENGR 4250 Material Selection In Engineering Design: 3 semester hours
PREREQUISITES: Senior standing. Analysis of the scientific bases of material behavior in the light of research contributions of the last 20 years. Development of a rational approach to the selection of materials to meet a wide range of design requirements for conventional and advanced applications. Although emphasis will be placed on mechanical properties, other properties of interest in design will be discussed, e.g., acoustical, optical and thermal.

J M ENGR 4310 Control Systems I: 3 semester hours

J M ENGR 4440 Solar Energy: 3 semester hours
Prerequisites: J M ENGR 3200, J M ENGR 3700, and J M ENGR 3710. This course will cover the following topics: extraterrestrial solar radiation; solar radiation on the earth's surface; weather bureau data; review of selected topics in heat transfer; methods of solar energy collection including flat panel and concentrating collectors; solar energy storage; transient and long-term solar system and performance.
J M ENGR 4630 Nanotechnology: Concepts And Applications: 3 semester hours

J M ENGR 4700 Sustainable Environmental Building Systems: 3 semester hours
Sustainable design of building lighting and HVAC systems considering performance, life-cycle cost and downstream environmental impact. Criteria, codes and standards for comfort, air quality, noise/vibration and illumination. Life cycle and other investment methods to integrate energy consumption/conservation, utility rates, initial cost, system/component longevity, maintenance cost and building productivity. Direct and secondary contributions to acid rain, global warming and ozone depletion.

J M ENGR 4810 HVAC Analysis and Design I: 3 semester hours

J M ENGR 4820 HVAC Analysis and Design II: 3 semester hours
Prerequisites: Senior standing. Energy calculations to estimate the quantity of energy needed to heat and cool building structures. Fundamentals of incompressible flow, basics of centrifugal pump performance, and design procedures for water piping systems. Space air diffuser design to assure that temperatures, humidities, and air velocities within occupied spaces are acceptable. Air duct design and fan analysis for optimally distributing air through building air duct systems. Performance analysis of refrigeration systems, including the effects of pressure losses and heat transfer. Direct contact heat and mass transfer.

J M ENGR 4900 Engineering Project Management: 3 semester hours
Basic fundamentals and advanced concepts of engineering project management applicable to projects and programs, both large and small. Project management skills, techniques, systems, software and application of management science principles will be covered and related to research, engineering, architectural, and construction projects from initial evaluations through approval, design, procurement, construction and startup.