CHRONOLOGY OF ACADEMIC SCHEDULE AND EVENTS

2004-2005 Academic Year

January 4 Tuition for Terms C and D Due
January 9 Residence Halls Open for Term C
January 10-14 Web Enrollment for Spring Semester
January 12 Deadline for Completion of Degree Requirement Forms for February 2005 Candidates
January 13 First Day of Classes, Term C
January 17 First Day of Classes for Graduate Courses
February 17 Advising Appointment Day (No Undergraduate Classes)
March 3 Last Day of Classes, Term C
March 4 Reserved for Weather-Cancellation Makeup
March 15 First Day of Classes, Term D
April 19 Project Presentation Day (No Undergraduate Classes)
April 21-22 Project Registration for ’05-’06
April 28 Deadline for Completion of Degree Requirement Forms for May 2005 Candidates
April 29 Last Day of Classes for Semester Courses
May 3 Last Day of Classes, Term D
May 5 12 noon - Residence Halls Close
May 16 First Day of Classes, Summer Session
May 20 Baccalaureate Ceremony
May 21 Spring Commencement
May 30 Memorial Day Holiday
June 10-12 Alumni Reunion
July 4 Independence Day Holiday observed (no classes)
August 24 Deadline for Completion of Degree Requirement Forms for Fall 2005 Candidates

2005-2006 Academic Year

August 10 Tuition for Terms A and B Due
August 20 Residence Halls Open for NEW Students; New Student Orientation (Freshmen/Transfer) Begins
August 21 Residence Halls and Apartments Open for Returning Students
August 22-26 Web Enrollment for Fall Semester
August 24 Deadline for Completion of Degree Requirement Forms for Fall 2005 Graduation
August 25 First Day of Classes, Term A
August 25 (Thurs.) Follow MONDAY Class Schedule

September 4 Labor Day Holiday (No Classes)
September 5 First Day of Classes for Graduate Courses
September 23 Presidents’ IQP Awards Entry Deadline
September 30-October 1 Homecoming
October 13 Last Day of Classes, Term A
October 14-24 Fall Recess
October 25 First Day of Classes, Term B
October 25 (Tues.) Follow FRIDAY Class Schedule
November 23-27 Thanksgiving Recess (Last Day of Class - Graduate Students - November 21) (Last Day of Class - Undergraduates - November 22)
December 7 Presidents’ IQP Award Competition
December 15 Last Day of B-term Classes
December 16 12 noon - Residence Halls Close For Term Break
December 16-11, 2006 Winter Recess
January 3 Tuition for Terms C and D Due
January 8 Residence Halls Open for Term C
January 9-13 Web Enrollment for Spring Semester
January 11 Deadline for Completion of Degree Requirement Forms for February 2006 Candidates
January 12 First Day of Classes, Term C
January 16 First Day of Classes for Graduate Courses
February 16 Advising Appointment Day (No Undergraduate Classes)
March 2 Last Day of Classes, Term C
March 3 Reserved for Weather-Cancellation Makeup
March 3-13 Spring Recess
March 14 First Day of Classes, Term D
April 18 Project Presentation Day (No Undergraduate Classes)
April 27 Deadline for Completion of Degree Requirement Forms for May 2006 Candidates
April 28 Last Day of Classes for Semester Courses
May 2 Last Day of Classes, Term D
May 4 12 noon - Residence Halls Close
May 19 Baccalaureate Ceremony
May 20 Spring Commencement
May 29 Memorial Day Holiday
May 15 First Day of Classes, Summer Session-Tentative
June 9-11 Alumni Reunion
July 4 Independence Day Holiday (no classes)
August 23 Deadline for Completion of Degree Requirement Forms for Fall 2006 Candidates
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**Key Dates:**

- **September 5:** Labor Day
- **November 24:** Thanksgiving
- **April 18:** Project Pres. Day
- **May 29:** Memorial Day
- **July 4:** Independence Day
- **FEBRUARY 16:** Academic Advising Day (Project Opportunities)
- **MARCH 3:** Snow Day (As Needed)
- **FEBRUARY 16:** Academic Advising Day (Project Opportunities)
- **APRIL 18:** Project Pres. Day
- **MAY 29:** Memorial Day
- **JULY 4:** Independence Day
- **SEPTEMBER 5:** Labor Day

**Additional Notes:**

- **August 25 = MONDAY schedule**
- **October 25 = FRIDAY schedule**
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**Cultural and National Holidays:***
- **September 5, Labor Day**
- **November 24, Thanksgiving**
- **May 29, Memorial Day**
- **July 4, Independence Day**

**Graduation Dates:**
- **Spring:** May 29
- **Fall:** July 4

**Special Dates:**
- **August 5:** Lab Day
- **March 29:** Graduation
WPI educates talented men and women in engineering, science, management, and humanities in preparation for careers of professional practice, civic contribution, and leadership, facilitated by active lifelong learning. This educational process is true to the founders’ directive to create, to discover, and to convey knowledge at the frontiers of academic inquiry for the betterment of society.

Knowledge is created and discovered in the scholarly activities of faculty and students ranging across educational methodology, professional practice, and basic research. Knowledge is conveyed through scholarly publication and instruction.

Adopted by the Board of Trustees, May 22, 1987

THE GOAL OF WPI

WPI was founded in 1865 to create and convey the latest science and engineering knowledge in ways that would be most useful to the society from which its students came. Since that time, the disciplines of human inquiry have expanded extraordinarily, as have WPI’s constituencies. The WPI curriculum, accordingly, has been reshaped numerous times, but it has remained true to its original mission of fusing academic inquiry with social needs, of blending abstraction with immediacy, of linking new knowledge to applications.

The goals of the undergraduate program are to lead students to develop an excellent grasp of fundamental concepts in their principal areas of study; to lay a foundation for life-long renewal of knowledge; to gain a mature understanding of themselves; and, most importantly, to form a deep appreciation of the interrelationships among basic knowledge, technological advance, and human need. These principles are today manifest in the WPI Plan, a unique, project-oriented program which emphasizes intensive learning experiences and direct application of knowledge. WPI remains committed to continued educational improvement and innovation.

The goals of WPI’s programs of graduate instruction and research are to create and convey knowledge at the frontiers of academic inquiry. These endeavors are founded on the principle that vigorously pursued and rigorously assessed scholarship is the lifeblood of the institution. High quality graduate instruction conveys the arts of scholarship to new generations, and it assists working professionals in maintaining currency in a world where knowledge becomes obsolete with ever-increasing rapidity.

A WPI education encompasses continuous striving for excellence coupled with an examination of the contexts of learning so that knowledge is won not only for its own sake but also for the sake of the human community of which the people of WPI are part.

Endorsed by the WPI Faculty on March 5, 1987, and by the Board of Trustees on October 16, 1987.

A STATEMENT OF VALUES FOR UNDERGRADUATE EDUCATION AT WPI

1. WPI’s programs shall emphasize fundamental concepts, knowledge, and skill, and ensure that students are able to apply them within the context of their major disciplines.
2. WPI’s programs shall emphasize the development of students as effective thinkers and communicators, able to use evidence to present their ideas with logic, clarity, and persuasion.
3. Programmatic breadth in general, and balance between technical and humanistic components in particular, are the hallmarks of a WPI undergraduate education. In addition to educating students in their major discipline, WPI’s programs shall provide students with a broad preparation for fulfilling lives as responsible professionals and informed citizens.
4. Grounded in project and course experiences, a WPI education shall provide a firm foundation for life-long learning in a variety of fields. WPI programs shall emphasize inquiry-based learning and open-ended problem solving. Students shall bear a considerable responsibility for learning outside of the classroom.
5. WPI’s programs shall be sufficiently flexible so as to allow students significant choice in and responsibility for planning their courses of study. Faculty, via the central teaching tasks of project and academic advising, shall ensure that student learning experiences encourage critical reflection, decision making, and personal growth.
6. WPI’s programs shall emphasize the scientific, technical, societal, and humanistic contexts in which knowledge is applied and constructed. Education activities shall challenge students to make connections between disciplines, to consider multiple viewpoints, and to appreciate the consequences of their actions. The curriculum shall prominently feature integrative and interdisciplinary activities.
7. WPI’s learning environment and educational activities shall balance personal responsibility and individual accountability with cooperation, collaboration and mutual respect. Members of the community shall be encouraged to value academic integrity, and to become conscious of the value that such integrity confers to themselves and to the community.
8. WPI shall be committed to assessment and improvement of student learning.
Graduates of WPI will:

1. have a base of knowledge in mathematics, science, and humanistic studies.
2. have mastered fundamental concepts and methods in their principal areas of study.
3. understand and employ current technological tools.
4. be effective in oral, written and visual communication.
5. function effectively both individually and on teams.
6. be able to identify, analyze, and solve problems creatively through sustained critical investigation.

7. be able to make connections between disciplines and to integrate information from multiple sources.
8. be aware of how their decisions affect and are affected by other individuals separated by time, space, and culture.
9. be aware of personal, societal, and professional ethical standards.
10. have the skills, diligence, and commitment to excellence needed to engage in lifelong learning.

**WPI’S COMMITMENT TO PLURALISM**

Pluralism, as a social condition, means that several distinct ethnic, religious, and racial communities live side by side, have equitable access to resources, are willing to affirm each other’s dignity, are ready to benefit from each other’s experiences, and are quick to acknowledge each other’s contributions to the common welfare. Recognizing the importance of pluralism to creativity, innovation, and excellence, WPI is dedicated to creating an atmosphere that encourages diversity in all aspects of campus life—from academics, to residence hall living, to social interactions among students, faculty, and staff. The Institute recognizes the special obligation of promoting a multicultural community based on mutual respect and tolerance. This commitment is part of WPI’s institutional plan for encouraging pluralism and increasing diversity, a plan that proclaims the importance of having students understand and appreciate other cultures, and prepares them fully to pursue rewarding careers in an increasingly global economy.

*Concepts endorsed by the WPI Faculty on April 21, 1994.*
WPI, the nation’s third oldest private technological university, was established in 1865 by the New England industrialists John Boynton, Ichabod Washburn, and their associates. Boynton and Washburn endowed the first two buildings on campus, as academic classrooms and practical shops. Boynton Hall and the Washburn Shops — renovated today into state-of-the-art facilities — still preserve their distinctive original towers. These “Two Towers” represent WPI’s continued commitment to academic excellence through real-life project experience that synthesizes classroom learning.

The “Two Towers” tradition of academic achievement and practical application is reflected in WPI’s motto, “Lehr und Kunst” or “Theory and Practice.”

WPI has awarded graduate degrees since 1898, adding new programs regularly in response to the developing needs of the professional world. WPI is among the top 50 science colleges in the nation in terms of the percentage of undergraduates who receive doctorates. Presently, WPI offers the master’s degree in 25 disciplines and the doctorate in 14.

The current student body of over 3,600 men and women includes about 1,000 full- and part-time graduate students. Currently, students attend WPI from almost every state and over 60 foreign nations.

THE WPI PLAN

In 1970 WPI adopted a revolutionary new undergraduate program known as the WPI Plan. The Plan replaced the traditional rigidly-prescribed curriculum — typical of conventional engineering education — with a flexible, exciting, and academically challenging program aimed at helping students to learn how to learn.

The Plan continues the “Two Tower” tradition by synthesizing classroom experience in projects that solve real-world problems. The WPI project program prepares graduates for their future professional lives by helping them learn how to identify, investigate and report on open-ended problems. Alumni indicate that project experiences also prepare them uniquely well for managing team efforts, and for communicating both in oral and written forms according to professional standards.

All WPI students complete three projects. The Major Qualifying Project (or MQP) challenges students to solve problems typical of those to be encountered in their professional discipline. The Interactive Qualifying Project (or IQP) presents an issue at the intersection of science, technology, and culture, and emphasizes the need to learn about how technology affects societal values and structures. Also, students complete a Sufficiency project on a theme emerging from a five-course, self-selected series of courses in Humanities and Arts, thus insuring that WPI students develop an understanding of the humanities as well as of technology. Taken together, the three projects emphasize that technological professionals must learn not only to create technology, but also to assess and manage the social and human consequences of that technology.
WPI students must prepare to live and work in the interdependent world of the next century. Professionals no longer can study, and live in ignorance of other countries and cultures, as professional practice and commerce increasingly cross over national boundaries.

WPI thus emphasizes real-world project experience, and provides extensive opportunities for studying the kinds of global issues that will dominate professional and political life in the 2000’s.
Project Sites

- Bangkok, Thailand
- Boston, Mass., USA
- Copenhagen, Denmark
- Greenbelt, Maryland, USA
- Hong Kong, PRC
- Limerick, Ireland
- London, England
- Madrid, Spain
- Melbourne, Australia
- Nancy, France
- San José, Costa Rica
- San Juan, Puerto Rico, USA
- Silicon Valley, Calif., USA
- Venice, Italy
- Wall Street, New York
- Washington, D.C., USA
- Worcester, Mass., USA
To support classroom and project work, WPI makes every effort to provide students with hands-on experience with state-of-the-art research and support facilities. Below are a few of the facilities available to WPI undergraduates:

### COMPUTER RESOURCES

#### RESOURCES IN FULLER LABORATORIES

WPI’s newest academic building, Fuller Laboratories, is designed to provide dedicated space for faculty, staff and students working in the information sciences. The Computing and Communications Center (CCC) is located in this building, along with the Computer Science Department and the Academic Technology Center.

CCC provides a wide range of services and access to computer resources for the WPI community and manages an array of powerful UNIX, Linux and Windows servers. All WPI students, faculty and staff may obtain a login ID from the CCC for academic course works, research and self-education. The ID will remain in force as long as the person continues to be registered as a student or to be employed by WPI. The systems have been configured so that the user will see the same familiar environment no matter which CCC workstation is used. CCC facilities are accessible from a wide variety of locations on campus or from around the world via the campus connection to the Internet. CCC operates the campus data network and Internet connectivity, including a VPN (Virtual Private Network) to access internal resources remotely. Computer systems operated by academic departments are also on the same CCC communications infrastructure, so they are accessible just as easily.

The CCC facilities offer x-terminals with Linux servers, as well as high-end PCs and several Macs. In addition to several computer classrooms and specialized labs, the CCC supports open access labs in every academic building totaling hundreds of stations across the campus. Each of these labs offers the same user interface, software profile, and network access to personal files as does the CCC lab.

PC file servers drive laser printers in the CCC facilities and other locations across campus. Also accessible in the CCC are a color postscript laser printer and scanning devices. Since the campus network distributes computing services across the campus, network-attached PCs in other buildings can use the CCC print service to generate high-quality output for reports and resumes. The servers also provide file service for many software packages including PC-based desktop publishing, spread sheets, databases, programming languages, and department courseware.

CCC supports the residence and fraternity network services. Using their personal PCs, students in residence halls can access the same software and interface available in CCC PC labs across campus. A wireless network is available in all academic buildings as well as primary residence centers. Wireless laptops are available on loan for use in the library and campus center.

In addition to supporting the academic computing system on campus, CCC operates the administrative system that provides data processing services to WPI administrative offices. The WPI information system provides ready access to important registration information. Students update their biographical information, check grades and drop/add courses over the network via the web interface to the administrative system.

CCC manages a computer help desk to answer users’ questions on any of the computer platforms and to provide technical support for endorsed software packages. CCC also provides instruction sessions on supported software in the state-of-the-art computer-training classroom that the CCC maintains in the Gordon Library.

#### GENERAL COMPUTER SCIENCE DEPARTMENT FACILITIES

**Fuller 2nd Floor**

The department is housed in the specially designed Fuller Laboratories building, providing substantial office and laboratory space. A wide variety of computing equipment is available for course work, project work, and research in computer science.

The department has multiple Sun UltraSPARC, SGI, and Intel machines running Solaris, IRIX, Linux, and other operating systems, for interactive use. These may be accessed via roughly 70 PC’s located in department offices, as well as from any of CCC’s publicly available computers.

Every classroom, laboratory and office in Fuller Labs is connected to the campus-wide high speed communications network. The network provides access to other computing resources, including the Computing and Communications Center, and the Internet.

#### RESOURCES IN HIGGINS LABORATORIES

**KECK DESIGN CENTER [Mechanical Engineering]**

**The Computer Classroom**

**2nd Floor**

The Keck Design Center contains computer workstations with state-of-the-art computer-aided design software for mechanical devices and is primarily used to support entry-level CAD courses. The software also allows the modeled geometry to be transported to other analysis packages available in the Center.

Laboratory lectures are held in this room which allows the instructor to lecture and the students have hands-on availability of the material being presented.
The Design Studio
2nd Floor
The Design Studio provides an environment linked by computational equipment and networks to outside manufacturing facilities. High-end Sun Workstations, with software support for video-picture-within-the-monitor teleconferencing, provide two-way communication of audio, video, and data between the Design Studio and to off-campus sites.

In the computationally equipped studio, students have clustered seating around multiple workstations. Design work can be done on the workstations and discussed or analyzed with off-campus sponsors or collaborators in real time as changes are made. Part files can be ported to rapid prototyping machines or lithography units within the Design Studio and beyond. Video cameras at the prototyping stations show the real-time fabrication within a window on the workstations.

RESOURCES IN THE WASHBURN LABORATORIES

HAAS TECHNICAL CENTER FOR COMPUTER-CONTROLLED MACHINING
[Mechanical Engineering] First Floor
The center is primarily for undergraduate teaching and projects. The eight new CNC machine tools include a lathe with live tooling and a barfeeder, as well as two vertical machining centers with four, and more, axes. They are used in ME 1800, ME 3820, and ES 3323. The machine tools provide for the fabrication, i.e., realization, of parts, especially those designed on computers. The machine tools are important for supporting WPI’s project-based education. The machine tools are also used in graduate education and manufacturing engineering research, as well as to produce apparatus to support research efforts in other fields. The center is part of a network of over 30 other colleges and universities in North America which also have Haas Technical Centers designed by Haas Automation, Oxnard, CA.

MANAGEMENT MICROCOMPUTER LABORATORY
[Management] Second Floor
The Management Microcomputer Lab contains fifteen personal computers that are networked to the University backbone. Spreadsheet, word processing, and database management packages are accessible from the lab, as well as software for simulation, quality control, and management science analyses. Students use the lab for course work and projects. The lab is open during normal business hours for the Department of Management and until 10 pm weekdays only.

THE MANUFACTURING DESIGN STUDIO
[Mechanical Engineering] First Floor
The eight (8) Sun workstations and 10 PCs, with CAD and CAM software, in the Manufacturing Design Studio are linked through WPI’s computer network to the CNC machine tools in the Haas Technical Center. This provides a modern multi-user design and prototype production facility for student use for projects, research and class/lab work.

MANUFACTURING ENGINEERING RESEARCH CENTER
[Mechanical Engineering] First Floor
This consists of six laboratories: Haas Technical Center, Manufacturing Laboratory, Computer-aided Manufacturing Lab, Machining Dynamics Lab, Surface Metrology Lab, and the Robotics Lab. These include a wide variety of instrumentation, measurement and computational and facilities for the control and monitoring, modeling and design of manufacturing tools, products and processes. The center also has access to external machine shop facilities.

These labs combine a large machinery bay area with an attached air-conditioned computer laboratory. Equipment in the Robotics Lab includes a number of industrial robots, a Coordinate Measurement Machine (CMM), a machining area with CNC machine tools, and specialized automation equipment interfaced to PLC’s. The Surface Metrology Laboratory has scanning laser microscopes, conventional profilers, specialized software for analyzing measured surface fixtures, including fractal analysis. The CAM Lab includes several Unix-based engineering graphics workstations used for CAD, solid modeling, kinematics analysis, FEA, CIM and expert system development, and a number of computers set up for data acquisition and real-time control. Cooperative research is frequently done with faculty in many areas.

MIS/OIE ORACLE/LEAN LAB
[Management] Second Floor
The Department of Management is a participating member in Oracle Corporation’s Oracle Academic Initiative. OAI participants integrate Oracle products in a number of their courses to provide students with real-world experience working with enterprise systems. The MIS/OIE Oracle/Lean Lab is located in WB228. In addition to 24 high-end desktop computers with flat panel screens, the lab houses numerous servers as well as older computers and servers used for test purposes. Each computer is wired to the university backbone through a 100 megabit connection. Additionally, there is an internal network that is used with the Department’s servers. In the future, the internal network will also connect to an adjacent classroom, WB229, which will have connections at each seat for that and the university network.

In addition to the computing resources available in the MIS/OIE Oracle/Lean Lab, moveable tables support process-oriented laboratories associated with lean design and the OIE program.
PROJECT AND EDUCATIONAL FACILITIES

ADVANCED CASTING RESEARCH CENTER
(See full description under Research Centers and Institutes on page 11.)

CENTER FOR HEAT TREATING EXCELLENCE (CHTE)
(See full description under Research Centers and Institutes on page 11.)

MORRIS (BUTCH) BOORKY POWDER METALLURGY RESEARCH CENTER (PMRC)
(See full description under Research Centers and Institutes on page 11.)

COMPUTER SCIENCE PROJECT LABORATORIES
Fuller
Because project work is a significant part of a WPI education, the Computer Science Department has several laboratories devoted to undergraduate and graduate project work. These laboratories have a wide variety of computer equipment available for student use.

DISCOVERY CLASSROOM
[Mechanical Engineering] Higgins: Second Floor
This state-of-the-art classroom provides a non-traditional, discovery-based learning environment that supports learning modules which unify the analytical, computational, and experimental engineering approaches. The room seats 90 and features experimental facilities that allow students to examine the details of physical phenomena during interactive class exercises. A multi-purpose laboratory adjacent to the classroom permits small-group exercises and design work.

ENGINEERING EXPERIMENTATION LABORATORY
[Mechanical Engineering] Higgins: Basement
The Experimental Laboratory provides the support for undergraduate courses designed to develop analytical and experimental skills in modern engineering methods based on current electronic instrumentation and computer-based data acquisition systems. Engineering analysis and design, and the principles of instrumentation are emphasized. The laboratory affords the student an opportunity to use modern devices in actual experiments in areas such as heat transfer, flow measurement and visualization, force/torque/strain measurements, motion and vibration measurements, and laser applications.

HAAS TECHNICAL CENTER FOR COMPUTER-CONTROLLED MACHINING
(See full description under Resources in Washburn Laboratories on page 9.)

MECHANICAL ENGINEERING PROJECT LABORATORY
[Mechanical Engineering] Higgins: Basement
The Project Lab is a dedicated multipurpose laboratory for Major Qualifying Projects, which need construction and storage space. This lab includes a fully staffed machine shop to assist the students in the design, layout and fabrication of components needed for students’ experiments.

RESEARCH CENTERS AND INSTITUTES
A number of faculty members have formed multi-disciplinary research centers and institutes at WPI. These active research centers and programs provide excellent and unique interdisciplinary research opportunities. All of these centers and groups conduct outstanding state-of-the-art research sponsored by governmental and industrial agencies.

The centers listed and described below offer opportunities to undergraduates to work with ongoing research activities through MQPs, industrial internships, coop opportunities, summer employment and international project activities.

CENTER FOR HOLOGRAPHIC STUDIES AND LASER TECHNOLOGY (CHLST)
[Mechanical Engineering] Higgins: First Floor
The CHLST was founded in 1978 and is furnished with state-of-the-art facilities which are used for research and educational activities. These activities range from fundamental studies of laser light interaction with materials to sophisticated applications in metrology.

The CHLST research is in areas relating to microelectronics, radar technology, microtechnology, micromechanics, submarine technology, jet engine technology, avionics, biomedicine, modern powder materials, ceramics, composites, energy systems, micro-scale material science and engineering, interconnection technology, and computational modeling. The strength of the CHLST lies in a comprehensive utilization of laser technology, optics, computational methods, mechanical engineering, materials science and engineering, and computer data acquisition and processing. Building on these strengths, greatly diversified projects in a number of areas of current interest are being conducted using the Center’s own technique and innovative methods.

The CHLST develops and maintains cooperative and exchange programs with leading teaching and research institutions in the United States and abroad.
The Metal Processing Institute (MPI) is an industry-university alliance. Its mission is to design and carry out research projects identified in collaboration with MPI's industrial partners in the field of near and net shape manufacturing. MPI creates knowledge that will help enhance the productivity and competitiveness of the metal processing industry, and develops the industry's human resource base through the education of WPI students and the dissemination of new knowledge. More than 100 private manufacturers participate in the institute and their support helps fund fundamental and applied research that addresses technological barriers facing the industry. The MPI researchers also develop and demonstrate best practices and state-of-the-art processing techniques.

MPI offers educational opportunities and corporate resources to both undergraduate and graduate students. Specifically,
- International exchanges and internships with several leading universities around the globe—Europe and Asia.
- MQP opportunities with the industrial sector wherein the students spend the summer months prior to their senior year in industry.
- Graduate internship programs leading to a Masters or Doctoral degree where the research work is carried out at the industrial site.

For further details visit the MPI office on the third floor of Washburn, Room 326, or the MPI website: www.wpi.edu/+mpi.

MPI's research programs are carried out by three distinct research consortia. These are described below:
- Advanced Casting Research Center (ACRC)
- Center for Heat Treating Excellence (CHTE)
- Morris (Butch) Boorky Powder Metallurgy Research Center (PMRC)

**ADVANCED CASTING RESEARCH CENTER (ACRC)**
**[Mechanical Engineering] Washburn: Basement**

The laboratory provides experimental facilities for course laboratories and for undergraduate and graduate projects. The laboratory is equipped with extensive melting and casting facilities, computerized data acquisition systems for solidification studies, thermal analysis units, liquid metal filtration apparatus, rheocasting machines and a variety of heat treating furnaces. The laboratory has strong collaborations with industry and students work directly with professional engineers from sponsoring companies. Fifty-five corporate members participate in and support the casting research programs. Student scholarships offered by the Foundry Education Foundation (FEF) are available through the laboratory. The ACRC conducts workshops, seminars, and technical symposiums for national and local industries. The laboratory is available throughout the year for project activity and thesis work as well as summer employment. Project opportunities at international sites are also available through ACRC/MPI.

**CENTER FOR HEAT TREATING EXCELLENCE (CHTE)**
**[Mechanical Engineering] Washburn: Third Floor**

The center is an alliance between the industrial sector and researchers to collaboratively address short-term and long-term needs of the heat treating industry. It is the center's intent to enhance the position of the heat treating industry by applying research to solve industrial problems and to advance heat treatment technology. The center's objective is to advance the frontiers of thermal processing through fundamental research and development.

Specifically, the center will pursue research to develop innovative processes to:
- Control microstructure and properties of metallic components
- Reduce energy consumption
- Reduce process time
- Reduce production costs
- Achieve zero distortion
- Increase furnace efficiency
- Achieve zero emissions

Over thirty-five corporate members participate and support the CHTE research programs. MPI project opportunities, industrial internship, and summer employment are available through CHTE/MPI.

**MORRIS (BUTCH) BOORKY POWDER METALLURGY RESEARCH CENTER (PMRC)**
**[Mechanical Engineering] Washburn: Third Floor**

The center addresses the scientific, engineering, and managerial problems of the powder metallurgy industry. By integrating facilities from different disciplines, the center has developed research programs in engineering and management, addressing new technologies as well as methodologies for their implementation, i.e., valve creation and management issues in a small fragmented industry. The objectives of the PMRC are as follows:
- Establish an educational and research center for the powder metallurgy industry, and to provide a vehicle for manufacturing excellence and competitiveness of the industry.
- Establish long-term relationships between the academic community and members of management, manufacturing, and research in the industry.
- Develop course and project experiences for graduate and undergraduate students that will foster an understanding of the industry.

Eighteen corporate members participate and support the PMRC research programs. MQP project opportunities, industrial internships, and summer employment are available through PMRC/MPI.
RESEARCH LABORATORIES AND FACILITIES

These labs are MQP and research activity opportunities.

AEROSPACE LABORATORY
[Mechanical Engineering] Higgins: Basement
These experimental facilities provide support for courses, major qualifying projects, faculty and graduate student research. The facilities and instrumentation include a closed-return, high quality 2’x2’ wind tunnel, a subsonic open-return wind tunnel with a 18”x24” test section, a supersonic flow facility, laser Doppler velocimeter, hot-wire anemometry system, laser diagnostics, an intensified camera system, and computer data acquisition systems, and an ultrasonic measurement system.

ANALOG/MIXED SIGNAL MICROELECTRONICS LABORATORY
[Electrical and Computer Engineering Department] Atwater Kent
The Analog/Mixed Signal Microelectronics Research Laboratory comprises instrumentation, workstations, and software for the complete integrated circuit design process. Full CAD software tools are available for schematic capture, simulation, layout, parasitic extraction, and layout-vs.-schematic verification. Fabrication facilities are available through MOSIS and the industry partners. The equipment required to test the fabricated circuits (thereby verifying the design principles and completing the design process) has been purchased with a grant awarded by the National Science Foundation under the CISE Research Instrumentation Grant program. The lab is a tremendous enabling resource for test and evaluation to “complete the loop” for the design process. Since the instrumentation capability extends to 2.5GHz speeds, this lab will be a valuable resource for many years to come.

BIOMECHANICAL ENGINEERING LABORATORIES
[Mechanical Engineering] Higgins: First Floor
This complex provides experimental and computational facilities for the laboratory component of courses, major qualifying projects, and graduate research. The Biomechanical Engineering Laboratory complex includes the following:

The Biomechanics/Biofluids Laboratory: provides experimental facilities in the areas of biomechanics and biofluids. The laboratory has equipment for measuring force, deformation and kinematic variables as well as fluid flow, pressure and velocity. The laboratory contains PC-based computational and data acquisition facilities.

The Biomaterials Laboratory: is equipped for the evaluation of biological tissues, biomedical materials and surgical constructs with a focus on orthopedic and dental applications. The laboratory contains a computer controlled biaxial testing machine for use in these studies.

The Rehabilitation Engineering Laboratory: provides experimental facilities for the design, development and testing of electro-mechanical assistive devices. The Assistive Technology Resource Center is a part of the laboratory.

BIOPROCESS LABORATORY
[Biology and Biotechnology] Salisbury
The Department of Biology and Biotechnology has a 1600 square foot laboratory for courses, projects and research in bioprocess, which is the application of biotechnology and engineering principles to produce valuable products. This lab houses state-of-the-art equipment for fermentation, centrifugation, tangential flow filtration, rheometry, spectrophotometry, and high performance liquid chromatography. The lab is used for courses in Fermentation, Separation of Biological Molecules, Downstream Processing, and a course in Scale-Up that enables students to gain experience in bioprocessing at the 50 liter scale. This combination of facilities and courses gives WPI students experience unmatched by any other university in the country.

CENTER FOR SENSORY AND PHYSIOLOGIC SIGNAL PROCESSING - C(SP)2
[Electrical and Computer Engineering Department] Atwater Kent
Researchers within the C(SP)2 apply signal processing, mathematical modeling and other electrical and computer engineering skills to study issues related to human sensation and physiology. Currently, our major focus areas are vision, hearing, tactile reception and electromyography (EMG). In our vision research, we have digitally produced pulse code modulated patterns that evoke multicolor sensations from black and white and monochromatic flicker patterns. Hearing research is concentrating on improved signal processing in hearing aid devices to improve speech perception by the hearing impaired. The purpose of the tactile receptor studies is to develop an understanding of the stimulus encoder characteristics of tactile mechanoreceptors. In the area of EMG (the electrical activity of skeletal muscle), we are improving the detection and interpretation of EMG for such uses as the control of powered prosthetic limbs and musculoskeletal modeling.

CENTER FOR WIRELESS INFORMATION NETWORKING STUDIES (CWINS)
[Electrical and Computer Engineering Department] Atwater Kent
The Center for Wireless Information Network Studies is a renowned compact wireless research laboratory with a successful history of research alliances with other industrial and academic groups. The center has performed research for government agencies and has close ties with the world-leading organizations in the wireless industry.

The core competence of the center is in indoor radio channel propagation measurement modeling and in the development of testbeds and tools for design and performance monitoring of wireless indoor networks.

CERAMIC PROCESSING LABORATORY
[Mechanical Engineering] Washburn: Third Floor
This facility serves the Materials Science and Engineering Program, the Manufacturing Engineering Program, and other departments. The laboratory contains a variety of powder processing and characterization equipment, as well as equipment for green body consolidation and sintering. A specially equipped room houses the electric discharge-machining laboratory.
COMPUTATIONAL GAS AND PLASMA DYNAMICS LABORATORY (CGPL)
[Mechanical Engineering] Higgins: Second Floor
The mission of CGPL is to develop and apply advanced computational methodologies in the modeling of complex gas and plasma flows. Research studies in CGPL are focused on aerospace systems and technologies that include: electric propulsion, spacecraft-induced environment interactions, small thruster internal and plume flows, rarefied gas dynamics, magnetogasdynamics, and crystal growth in microgravity. Strong emphasis is placed in CGPL’s participation in space programs and missions. CGPL is equipped with several UNIX and personal workstations, data storage devices and printers.

COMPUTATIONAL FIELDS LABORATORY
[Electrical and Computer Engineering Department]
Atwater Kent
Our laboratory focuses on the fundamental research aspects and practical realizations of electromagnetic and nondestructive testing (NDT) problems of industrial interest. The investigations range from low (static and diffusion) to high-frequency (wave propagation) phenomena and include topics such as:
- NDT and Process Control
  - Electric Resistivity Testing of Powder Metallurgy Compacts
  - Eddy Current Testing of Steel Products
  - Clean Molten Metal Sensing Modeling
- Electromagnetics
  - Radio frequency signal propagation through multi-layer circuit boards
  - Temperature effects in power transistors
  - Pulsed hysteresis graph magnetization of permanent magnetic materials

CONVERGENT TECHNOLOGIES CENTER (CTC)
[Electrical and Computer Engineering Department]
Atwater Kent
The laboratories in this center combine diverse expertise for the exploration of the emerging and converging technologies of computing, communications and cognition. The Polaroid Machine Vision Laboratory (PMVL) and the Network Computing Applications and Multimedia (NETCAM) laboratory focus on the development of new algorithms and moving emergent technologies into commercial, medical and defense related applications for its sponsors.
Research in the NETCAM lab derives from the technologies generated by the success of the Internet, digital multimedia and distributed objects and middleware. Current projects explore the optimization of network protocols for multimedia, distributed object services (CORBA), and virtual reality based user interfaces.
Research in the PMVL lab has resulted in the development of highly efficient algorithms and new theoretical performance bounds for machine vision, automatic target recognition and image fusion for optical, IR, SAR, and SONAR data.

CRYPTOGRAPHY AND INFORMATION SECURITY (CRIS) LABORATORY
[Electrical and Computer Engineering Department]
Atwater Kent
The CRIS Laboratory conducts research and development in cryptography and its applications. One research focus are fast implementations of the next generation of public-key algorithms such as elliptic and hyperelliptic curve schemes. We work on fast software algorithms and efficient hardware architectures. The lab is equipped with industry-standard development tools for ASIC and FPGA target hardware. We also apply Xilinx FPGAs and Altera EPLDs to a new type of crypto systems which allow for a fast switch of private-key encryption algorithms (“algorithm agility”).
Another research focus is the integration of cryptography and data security into new communication networks. We work on the design and implementation of security protocols for wireless networks, with an emphasis on wireless LANs. Another network type of interest are high-speed Asynchronous Transfer Mode (ATM) networks. We investigate system design and algorithmic issues.

DATA/KNOWLEDGE BASE RESEARCH LABORATORY
[Computer Science] Fuller
The Data/Knowledge Base Research Laboratory supports research in very large data and knowledge base systems. Current research covers three topics; 1) distributed warehousing; 2) XML data management; and 3) continuous query processing systems. The laboratory is equipped with a number of Intel-based PCs.

DISTRIBUTED PROCESSING LABORATORY
[Computer Science] Fuller
The Distributed Systems Laboratory supports research and project work in distributed processing and distributed systems. The laboratory is equipped with a number of Intel-based PCs.

FIRE SCIENCE LABORATORY
[Fire Protection Engineering] Higgins: Basement
The Fire Science Laboratory supports small-scale and medium-scale experimentation in fire dynamics, combustion/explosion phenomena, detection, and fire and explosion suppression.
- Serving as both a teaching and research facility, the lab accommodates undergraduate projects as well as graduate students in fire protection engineering, mechanical engineering, and related disciplines.

FLUID DYNAMICS LABORATORY
[Mechanical Engineering] Higgins: Third Floor
This laboratory provides experimental facilities and instrumentation for experimental activities in the area of fluid dynamics. A small, open-return subsonic wind tunnel is available for use, and small experiments may be set up as required. Separate areas are provided for model preparation and small-scale experiments on space experiment packages.
HEAT TRANSFER LABORATORY
[ Mechanical Engineering] Higgins: Third Floor
This versatile laboratory provides adaptive workstations and experimental facilities for courses and projects in the general areas of heat transfer and combustion. It also includes equipment and experimental set-ups for graduate work in these areas.

HYDRODYNAMICS LABORATORY
[ Mechanical Engineering] Higgins: Basement
This laboratory provides experimental facilities and instrumentation for measurement of liquid flow phenomena. A closed-circuit free surface water tunnel with a 2 ft. by 2 ft. test section and a vertical water tank are available for project work and graduate research. These facilities are supported by data acquisition systems and various flow measurement devices.

LASER LABORATORIES
[ Mechanical Engineering] Higgins: First Floor
The Laser Laboratories are equipped with several systems utilizing He-Ne, Ar-ion, and Nd:YAG lasers. They are supported by a self-contained network of computers including printing and plotting facilities, as well as supporting instrumentation systems. The lasers, computers and supporting instrumentation are used in studies of fundamental phenomena governing high energy-density interactions in thin film imaging, with powder metal materials, plastics, ceramics, and composites, micromachining, underwater propagation, holography, displacement and strain measurement, vibrations, fracture mechanics, mathematical modeling, numerical computations, and applications to other problems of modern science, engineering and technology. This laboratory is available to students for course work, project work, and graduate research.

MANUFACTURING LABORATORY
[ Manufacturing Engineering] Washburn: First Floor
A range of manufacturing processes (sawing, drilling, grinding, bending, MIG and spot welding, and a large selection of manual and Haas CNC machine tools and eight (8) workstations and 10 PCs with CAD/CAM software) are available to support the academic programs in Manufacturing Engineering and Mechanical Engineering. Students can also draw on many other resources available, including a wide variety of robots, a coordinate measuring machine, and CAD/CAM systems.

See the Manufacturing Design Studio and Haas Technical Center for computer-controlled machining, under Resources in Washburn Laboratories on page 9.

MATHEMATICS LABORATORIES
[ Mathematical Sciences]
To complement WPI’s math classes, the department has two computer laboratories: The Statistics Multimedia Classroom, an interactive classroom with PCs; The Math Lab with X-terminals. The labs are also supported by a full time Computer Operations Manager and Instructors’ Associates who assist students with their mathematical computer needs.

MECHANICAL TESTING LABORATORIES
[ Mechanical Engineering] Washburn: First Floor
Experimental mechanical testing facilities are available for teaching and research related to mechanical properties and deformation of metals, ceramics, and composite materials. Equipment available includes:
- A computerized Servo-Hydraulic Tension-Compression System with supporting grips, environmental chambers, and furnaces.
- An Instron Computerized Tensile Tester for high accuracy, low load testing of ceramic materials.
- Two 55 kip computer-controlled Servo-Hydraulic Tension-Compression Systems with supportive grips, environmental chambers, and furnaces.
- Two high temperature and three room temperature stress-rupture systems.

NUCLEAR MAGNETIC RESONANCE (NMR) IMAGING FACILITY
[ Biomedical Engineering]
A Nuclear Magnetic Resonance (NMR) Imaging facility is located at the Central Massachusetts Magnetic Imaging Center (CMMIC) and is part of a joint research program between the Biomedical Engineering Department and the Department of Radiology at UMass Memorial Health Care. This facility houses a General Electric (GE) 2.0 Tesla (T) imaging spectrometer as well as a chemistry/electronics laboratory for sample preparation and radio frequency coil research. In addition to the 2.0 T instrument, two GE 1.5 T clinical imaging instruments are also available at CMMIC for suitable research projects.

OPTICAL AND ELECTRON MICROSCOPY LABORATORIES
[ Mechanical Engineering] Washburn: Second Floor
Two scanning electron microscopes (SEM), an analytical scanning transmission (AEM) electron microscope, optical reflection and transmission microscopes, and supporting sample preparation and photographic equipment are the major facilities available for microstructural analysis. SEM’s are available equipped with an Energy Dispersive X-ray (EDX) Analyzer, or equipped with stage-automated digital image analysis, a light element Quantum X-ray detector with a Kevek Delta system and a wavelength dispersive X-ray analyzer. The AEM is equipped with Kevek EDX system. These facilities are used primarily for microstructural analysis and determination of crystal structures of fine phases present in metals and ceramics.

PAVEMENT RESEARCH LABORATORY
[ Civil and Environmental Engineering] Kaven: Basement
The pavement research laboratory provides support for research and courses, major qualifying projects, faculty and graduate student. It is well equipped to conduct complete characterization of pavement materials. The state of the art array of equipment includes compactor, moisture susceptibility testing equipment, loaded wheel tester and extraction and recovery equipment. The laboratory contains some of the most advanced testing equipment - most notable of these are the material testing system (capable of conducting a wide range of tests, including stress-strain tests, indirect tensile strength, repeated uniaxial loading, Quality Control/Quality Assurance (QC/QA) frequency
sweep, resilient modulus, and triaxial shear strength), the Model Mobile Load Simulator (use of this equipment enables the simulation of a large amount of traffic within a short period of time and evaluation of long-term performance of pavement materials), and an array of Non-Destructive Testing equipment consisting of the Portable Seismic Property Analyzer, Falling Weight Deflectometer and Ground Penetrating Radar. In addition, WPI researchers will have access to field instrumentation available from the Maine DOT full-scale pavement loading and testing program. A major focus of the pavement engineering program is on integration of undergraduate and graduate curriculum with research projects funded by Maine Department of Transportation, Federal Highway Administration, New England Transportation Consortium and National Science Foundation.

POWER ELECTRONICS AND POWER SYSTEMS LABORATORY
[Electrical and Computer Engineering Department]
Atwater Kent
This laboratory has been established for simulation of a large variety of linear, non-linear and time-varying loads, including transistor and thyristor controlled loads. It contains transducers and instrumentation for a wide range of voltages, currents and frequencies. Compatible computer equipment and A/D interfaces are available for real-time data acquisition and processing. The laboratory has the basic facilities for electromechanical energy conversion study, including sets of induction/synchronous/DC machines coupled together.

SATELLITE NAVIGATION LABORATORY
[Electrical and Computer Engineering Department]
Atwater Kent
This laboratory provides facilities for work on civilian uses of satellite systems, especially the Global Positioning System. Receivers, signal processors and computers are provided for work on the utilization of the DOD BPS system for civilian purposes, especially aircraft navigation and landing.

SIGNAL PROCESSING AND INFORMATION NETWORKING LABORATORY (SPINLAB)
[Electrical and Computer Engineering Department]
Atwater Kent
The Signal Processing and Information Networking Laboratory (spinlab) provides test equipment and computational resources for MQPs and directed research projects in the areas of digital signal processing, wireless communication systems, software radio, and networking. Recent project sponsors include Bose Inc., General Electric Inc., and DARPA.

SOFTWARE ENGINEERING RESEARCH LABORATORY
[Computer Science] Fuller
The Software Engineering Research Lab houses the various software engineering projects led by Prof. George Heineman. The coordinating theme behind the projects is a strong emphasis on developing component-based software systems (CBSE) and providing tools and technologies to support CBSE. Professor Heineman actively pursues research in component-based software engineering, refactoring legacy systems to extract reusable software components, and approaches to monitor complex component-based systems.

SURFACE METROLOGY LABORATORY (SURF MET LAB)
[Mechanical Engineering] Washburn Second Floor
The Surf Met Lab is dedicated to supporting product and process design by advancing the understanding of surface topographies (i.e.; roughness) and the processes which make them. Topographic characterization methods are developed for the reduction of large topographic data sets, such as those acquired by atomic probe microscopy, confocal microscopy, scanning interferometric microscopes, and conventionalprofilers. The Surf Met Lab has: two scanning laser profilometers, a scatterometer (ARS), and a conventional profilometer. In addition, the Surf Met Lab has access to AFMs and other equipment through collaborations in the US, and Europe. The Surf Met Lab also has the use of sophisticated analysis software which employs fractal geometry principles.

ULTRASOUND RESEARCH LABORATORY
[Electrical and Computer Engineering Department]
Atwater Kent
The Ultrasound Research Laboratory in the Department of Electrical and Computer Engineering is an 800 sq. ft. facility set up for ultrasound experiments, numerical work, and development of electronic circuits. The lab contains measurement tanks, including a scanning tank with stepper motor controlled positioning system for the ultrasound measurements. Instrumentation is available for experimental ultrasound research, including pulser-receivers, computer systems, based ultrasound scanners. The ImagePoint digital ultrasound system is interfaced with a HP 16554 Logic Analyzer for digital data acquisition of ultrasound data from array transducers.

VIBRATIONS/CONTROL/DYNAMICS LABORATORY
[Mechanical Engineering] Higgins: Basement
The Vibrations Laboratory supports educational, project, and research activities in the areas of vibrations and controls. The equipment housed in this lab includes signal analyzers, a 100-lb. shaker table, and computational hardware and software for various vibrations and controls applications.

VISUALIZATION AND IMAGE SCIENCE LABORATORY
[Computer Science] Fuller
The VIS Laboratory is used for research in visualization, graphics, image processing, and computer vision. Current projects include large-scale multivariate data visualization, volume visualization, multiple object recognition, and model-based vision. The Lab contains an Intel-based server, several SGI workstations (an Octane, 2 O2’s, an Indy, and an Indigo 2), and a Pentium 2 PC.
VLSI DESIGN LABORATORY
[Electrical and Computer Engineering Department]
Atwater Kent
The VLSI laboratory supports state of the art design facilities based on both PC and workstation systems. These systems and software are available for the design, testing, simulation, layout and generation of analog, digital and mixed signal integrated circuits.

The software available is based on Tanner Tools for undergraduate and graduate course work, and on Tanner Tools or Cadence Design Systems EDA tools for project and thesis work. Both sets of tools support analog and digital design work. Additionally, the Tanner tools can be used for basic MEMS design work.

Integrated circuits can be fabricated through the MOSIS facility.

X-RAY DIFFRACTION LABORATORY
[ Mechanical Engineering] Washburn: Second Floor
Two fully-automated and computerized x-ray diffractometers are available for teaching and research. In addition, a variety of software has been developed to utilize these instruments effectively. Currently, background modeling, peak searching, and curve fitting with deconvolution, are in use for quantitative phase analysis and residual stress analysis. Search of the JCPDS Powder Diffraction File is available. A variety of x-ray cameras and goniometers are available along with the choice of x-ray tubes targets to provide a wide x-ray diffraction capability. Additional support software is shared with the Electron Microscopy Facility to generate diffraction patterns for any crystal system in any desired orientation.

MUSIC AND THEATRE FACILITIES

COMPUTER MUSIC LABORATORIES
Daniels Hall
These laboratories support creative and research activity in a variety of music- and sound-related applications including real-time virtual orchestra design and production techniques. The lab contains hardware and software for multi-track digital recording and editing, signal processing, algorithmic composition, sound synthesis, MIDI sequencing, music notation, and music programming.

GREAT HALL OF ALDEN
Alden Memorial: First Floor
The Great Hall is used for major productions in Theatre and Music. It is the venue for the Masque Theatre performances. The Hall is sometimes used, in addition, for festive and gala campus functions.

GREEN ROOM
Alden Memorial: First Floor
Alden Hall houses many of the theatre activities at WPI, both academic and extra-curricular. The Green Room serves as the laboratory for Department of Humanities and Arts, Division of Drama Theatre Performance projects and Sufficiencies, MQPs and IQPs. The sub-basement contains the scene shop and props-storage area and also holds a major work room for Lens and Lights. Students interested in theatre performance and Lens and Lights activities have many resources in Alden Hall.

GEORGE C. GORDON LIBRARY
The George C. Gordon Library invites all WPI students to take advantage of the services and resources that the library offers. The library is open over one hundred hours each week during the academic year and offers a comfortable atmosphere for study or relaxation.

The library’s Web site (http://www.wpi.edu/+library) is the focal point for library resources and services. The library catalog, electronic full-text journals, bibliographic databases and indexes, catalogs of remote libraries, and many other reference resources are available to students.

The library collection supports the curriculum and research needs of the WPI community. Currently the library holds over 273,000 volumes and subscribes to over 27,000 electronic books and over 11,000 electronic periodicals. The library collection also includes undergraduate project reports, graduate theses and dissertations, the WPI Archives, and Special Collections, most notably the Robert Fellman Dickens Collection. Library materials come in a variety of formats—print, audio, video, and digital. In addition to the many academic resources, the library also maintains a collection of popular books and magazines for leisure reading. Electronic collections are available from off-campus through the proxy server.

WPI students have access to the collections of other academic libraries within Central Massachusetts thanks to the library’s membership in the Academic and Research
Collaborative (ARC). You can find out which libraries participate in this program or acquire an ARC cross-borrowing card by visiting the library. Students can also request materials not held in Gordon Library from other libraries through the Interlibrary Loan Office and Document Delivery service.

Students will find that the Gordon Library staff is both knowledgeable in the use of library resources and ready to assist them with their information needs. The Reference Department helps students with research problems and questions, offers library instruction and orientation sessions, and provides special help to project groups. Members of the staff will be happy to provide students with additional information about library services and resources.

**ACADEMIC TECHNOLOGY CENTER**

The main office of the Academic Technology Center (ATC) is located in the southwest corner on the 1st floor of Fuller Laboratories. ATC provides a wide variety of technology-based services in support of the teaching and learning needs of students, faculty and staff, and serves as the central coordinating and distribution hub for most of the audio/video equipment utilized on campus. ATC supports all of the technology available in WPI’s electronic classrooms and conference rooms. In addition, instructional technology and audio/video equipment can be reserved and signed out for short periods of time to support educational needs. Equipment loans are for valid WPI projects and classes only, and are not for personal use. The ATC’s inventory of loan-out equipment includes laptop PCs, video/data projection systems, digital cameras, digital voice recorders, portable video equipment, VCRs, TV/VCR combination units, 35mm slide projectors, overhead projectors, small and large screens, and other miscellaneous items such as portable zip drives, wireless Ethernet cards, tripods, cables, etc.

In addition, the ATC offers graphic design and production services to faculty, staff and students. These include large format poster printing, print and 35mm slide scanning, copy standing, 35mm slide printing, and design assistance. Workshops on using multimedia and presentation graphics software, as well as covering effective design techniques are offered throughout the year.

Extensive multimedia development tools are available in the multimedia resource lab located in the Gordon Library, Room 208 (next to the Circulation Desk). The multimedia resource lab (a.k.a. the Movie Lab) contains 15 Multimedia PCs with 100mb Ethernet connections, DVD & RWs, two flatbed scanners, a PDF scanner, and an instructor station for workshops and classes. Each computer is fully loaded with popular multimedia software, including Photoshop and Illustrator for image editing, Cool Edit 2000 for audio editing, 3D Studio Max for animation as well as the Microsoft Office Suite and the full version of Acrobat. Students, faculty and staff have the option of producing their own material with or without the assistance of ATC staff.

ATC is also responsible for myWPI, the university’s learning and information portal. The myWPI portal is used in support of WPI’s academic programs, but also services the communication and collaboration needs of student organizations, faculty/staff committees, and other campus-wide initiatives. The myWPI portal is located at my.wpi.edu. For fastest assistance, please e-mail the myWPI support team at myhelp@wpi.edu.

A state-of-the-art instructional television classroom/studio and two adjacent control rooms are also available and are used primarily in support of WPI’s distance learning program – the Advanced Distance Learning Network (ADLN). Members of the WPI community who wish to produce a video in support of an educational activity can obtain professional assistance from the ATC (advanced notice is required). Production costs are usually covered by ATC. On-location productions using portable equipment can also be arranged but require additional preparation and planning.

The head end of the WPI cable TV network is located in the ATC. Announcements pertaining to campus events can be shown on the WPI Video Bulletin Board (submission forms can be obtained from the ATC website). In addition, the ATC operates and maintains WPI’s satellite receiver, capable of receiving both Ku and C-band transmissions; and WPI’s ISDN/IP-based videoconferencing systems.

For more information about the services available from the ATC, please refer to the department’s website at http://www.wpi.edu/+ATC.

**ADVISING AND STUDENT SERVICES**

**STUDENT DEVELOPMENT AND COUNSELING CENTER**

The WPI Student Development and Counseling Center (SDCC) provides a wide range of services that are FREE of charge to all students enrolled in classes at WPI. The primary purpose of the SDCC is to provide counseling, educational programming and training, referral, and crisis intervention services to the entire WPI student community focusing on 1) assisting students in their full and complete development as they go through the process of becoming adults so that they may achieve greater levels of personal, academic, and professional success, and 2) assisting students in becoming aware of, and effective in, their roles, relationships, and responsibilities as members of an ever burgeoning global society. The professional staff are trained to help students deal with a variety of issues including:

**Situational Problems**— poor academic performance; managing stress; time management; relationships with significant others; divorce or other family problems; feelings of loneliness, anger, anxiety, confusion, depression; loss; discrimination; harassment; alcohol or other substance problems; sleep disturbances; medical/physical conditions; learning disabilities.
Crisis-Related Problems—physical and/or sexual assault; impulse control problems; suicidal thoughts or behaviors; traumatizing experiences such as date rape, academic setbacks, or the loss of a loved one.

Developmental Issues—developing self-esteem; establishing personal and/or gender identity; helping to define sexual orientation; managing stress from earlier traumatic events; exploring personal and professional goals.

The SDCC staff can also provide referral services for psychiatric evaluation, psychological and learning disability assessment, or other treatment.

The services of the SDCC are confidential. The mental health professionals and support staff are highly trained and sensitive to students’ privacy and personal concerns.

The SDCC is located at West Street House, 157 West Street, near the corner of Institute Road. Appointments may be made during the academic year (A through E terms) in person or by calling (508) 831-5540. Office hours are 8:30 a.m. to 5:00 p.m. June to mid-August.

MAJOR SELECTION PROGRAM, A SERVICE OF THE CAREER DEVELOPMENT CENTER

Choosing a college major and its associated careers is one of the most important decisions you will make. The Major/Career Selection Program, or MSP, provides you the means to make that decision in an informed manner.

Why? We know that if you are in the “right major” and knowledgeable about the career paths available to you, you will enjoy your coursework, do better academically, and have a passion for your chosen work following graduation.

How can you select a major or learn more about a particular career path that leads to satisfaction? The answer is easy, through the information and experiences the MSP offers.

Contrary to what most people think, the MSP is not just for first-year students. It can help any WPI student to explore, identify and select a major and/or career field.

MSP activities include, but are not limited to:
- Academic Department presentations
- Company tours
- B-term seminar
- Career tests
- Individual Counseling

The CDC is located in the lower level of the Project Center. Appointments may be made in person or by calling (508) 831-5260. Office hours are 8:30 a.m.-5:00 p.m.

MASH (MATH AND SCIENCE HELP) PROGRAM

MASH is an academic support program for first-year students in mathematics and science courses. Offered to all students enrolled in a supported course, MASH provides assistance in regularly-scheduled study sessions beginning the first week of the term.

MASH review sessions are offered for a limited number of courses which students and faculty have identified as difficult. These courses may have heavy homework assignments or they may require understanding of new and difficult concepts. Whatever the reason, some courses are more challenging than others. MASH helps students meet that challenge.

Each study group is guided by a MASH leader, an undergraduate student who has taken the course before and who, therefore, understands the course material and what the instructor expects. MASH leaders attend all class lectures, take notes, complete assigned readings and other assignments, and conduct three or four 50-minute MASH sessions each week. By attending class and demonstrating effective student behavior, MASH leaders can assist students with the language of the discipline, the integration of lecture and readings, and the development of good study habits.

Through the MASH program, students become actively involved with the content material in a supportive environment. Studies show students who attend MASH sessions regularly earn higher grades than students electing not to participate. But even more important, MASH participants master new concepts, learn to put ideas into perspective, and develop a better way to study. MASH is offered by the Office of Academic Advising.

ACADEMIC RESOURCES CENTER

WPI’s Academic Resources Center (ARC) provides academic support services that are designed to enrich and enhance the learning experience of all WPI undergraduate students. Its student-based collaborative learning environment offers individualized assistance in a variety of subjects, as well as a comprehensive peer tutoring program, seminars and workshops.

Students may obtain individual counseling in such areas as learning styles, effective study strategies, problem solving and critical thinking skills, and time management. Appointments may be set up with staff members to develop individualized Academic Success Plans which help students set their academic goals, discover their learning strengths and weaknesses, and design the appropriate learning and study strategies that work best for them.

Students may call (508) 831-5281 for an appointment. Periodically, students may find that they need some individual assistance with a particular subject or topic. The ARC peer tutors, who are certified by the College of Reading and Learning Association, help students one-on-one in a variety of academic subjects. Tutors are available on a walk-in basis Monday through Thursday. See www.wpi.edu/Admin/ARC/tutorschedule.pdf for an up to date tutor schedule.

The Academic Resources Center is located in Daniels Hall.
STUDENT DISABILITY SERVICES OFFICE

The mission of the Student Disability Service Office is to ensure that all students with disabilities can freely and actively participate in all facets of University life; to provide and coordinate support services that enable students with disabilities to maximize their educational potential and to increase the level of awareness among members of the University so that students with disabilities are able to perform at a level limited only by their abilities, not their disabilities.

By law, it is the student’s responsibility to identify himself/herself to the Student Disability Services Office (DSO) and to provide documentation of the disability by a licensed professional. (Please note that the documentation for students with learning differences and ADD/ADHD must be dated within the last three years.) All students who have been admitted to WPI have the opportunity to self-identify their disability (physical and/or learning) by filling out the bottom portion of the Voluntary Disclosure form which is enclosed in the New Student Orientation Package. Students should send this form, along with the supporting documentation, to the DSO. Students with disabilities, who are diagnosed after their admission to WPI, must also provide appropriate documentation to the DSO, if they wish to receive accommodations.

For further information please visit the Disability Services web page at http://www.wpi.edu/Admin/Disabilities/transition.html. The Disability Services office, located in Daniels Hall, is open Monday – Friday 8:00 a.m. – 4:30 p.m. Students may drop in or call (508) 831-5235 for an appointment.

WRITING WORKSHOP A Division of the Center for Communication Across The Curriculum (CCAC)

The Writing Workshop offers all WPI students tutorial assistance on writing of any type: course assignments, project work, oral presentations, laboratory reports, proposals, resumes, and letters of application. The workshop is directed by a member of the Humanities and Arts Department faculty and staffed by student peer tutors, all of whom have been trained in a special course on tutoring writing. Students may be referred to the Workshop by faculty, or students may make appointments on their own initiative. The workshop is open according to posted schedules, and its tutorial services are available at no cost.

For more information, visit the Writing Workshop in the Project Center.

WRITING COURSES AND ADVISORS

For information on WPI’s writing programs, see Humanities and Arts faculty as follows:

Students for whom English is the native language can consult Prof. J. Trimbur (39 Dean St., Room 258) about these programs.

The WPI advisor for undergraduate students whose native language is not English is Prof. J. Forgeng (SL 08).

WORLD WIDE WEB

The WPI World Wide Web server is the campus information system. It contains a great deal of useful information about people and programs at the university, and is updated frequently. In addition, by using the Web, students gain access to a vast universe of information on any subject imaginable. This is why the Web is such a useful research tool for both faculty and students.

WPI’s Web address, or URL, is: www.wpi.edu. Questions about WPI’s Web site should be directed to the Web Development Office, webmaster@wpi.edu.
THE WPI PLAN

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WPI’s academic requirements are specifically designed to develop an overall educational experience which meets the goals of the college. Each requirement plays a supporting role as follows:

- To provide intellectual breadth and a better understanding of themselves, their cultures and their heritage, every WPI student must complete a **Humanities and Arts Sufficiency Project**;
- To provide an understanding of the priorities of other sectors of society, develop the ability to communicate effectively with disparate groups, organize and derive solutions to complex problems, and gain an awareness of the interrelationships between technology and people, every WPI student must complete an **Interactive Qualifying Project (IQP)**;
- To provide a capstone experience in the professional discipline, to develop creativity, instill self-confidence and enhance the ability to communicate ideas and synthesize fundamental concepts, every student must complete a **Major Qualifying Project (MQP)**;
- To provide for learning through an academic program with fabric and course balance while encouraging individual student choices within that framework, every student must fulfill **Distribution Requirements**.

### WPI TERMS AND CREDIT UNITS

The Bachelor of Science degree from WPI normally is based upon a residency at WPI of 16 terms. WPI operates on a quarterly system with four seven-week terms, two in the autumn semester (Terms A and B) and two in the spring semester (Terms C and D). A seven-week summer session, Term E, is also available. The normal academic load for each term is defined as one unit of work, usually divided among three courses or projects. Thus, the usual credit unit for courses or independent study/projects is 1/3 unit. **Qualifying Projects**, defined on pages 34-36, require one full unit of activity which may be concentrated into a single term (especially if conducted off-campus) or spread throughout an academic year. The degree will be awarded upon completion of the following:

### DEGREE REQUIREMENTS

1. **The Humanities and Arts Sufficiency Project** (See page 53) Qualification by overall evaluation of two units of work in the area. Students majoring in a scientific or engineering field or in business management or the social sciences fulfill the requirement in a humanities and arts area. Students majoring in a humanities and arts area fulfill this requirement in a scientific or engineering area.

2. **The Interactive Qualifying Project** (See page 38) Successful completion of a qualifying project relating science and/or technology to society (the Interactive Qualifying Project, or IQP) representing at least one unit of credit in project or independent study work. The format of the documentation is to be in accordance with current WPI policy on such documentation.

An IQP shall address a topic relating science and/or technology to society. In this context, both “society” and “technology” should be construed as broadly as possible. Technology refers to the application of rational and efficient principles to a body of knowledge or to the control of space, matter and/or human beings. Thus, the IQP encompasses not only techniques of production embodied in tools and machines, but also advances in methods of social and economic organization, in managerial techniques, and in methods of analysis in science, mathematics, and engineering.

Society refers not only to a grouping of individuals but also to the culture, values, laws, customs, and institutions shared by these individuals.

3. **The Major Qualifying Project** (See page 38) Successful completion of a qualifying project in the major area of study (the Major Qualifying Project, or MQP) representing at least one unit of credit in project or independent study work. The format of the documentation is to be in accordance with current WPI policy on such documentation.

4. **Distribution Requirements** (See page 27) Satisfaction of published academic activity distribution requirements in or relating to the major area of study. These requirements total no more than ten units (including the MQP) and are specified by general topical subject area, not by specific courses. Completion of distribution requirements will be certified by the appropriate departmental or Interdisciplinary and Global Studies Division (IGSD) Program Review Committee (PRC), upon recommendation by the student’s academic advisor. For students desiring designation of a major area for which a determination regarding distribution requirements has not previously been made and published, a faculty committee will be appointed by the department head or IGSD dean to review and approve the student’s program of study.

5. **Social Sciences** (See page 60) Completion of 2/3 unit of work in the social sciences, exclusive of qualifying project.

6. **Residency Requirement** A minimum of eight units must be completed satisfactorily in residence at WPI. (It is anticipated the normal residence at WPI will be 16 terms.)

7. **Minimum Academic Credit** The minimum academic credit required for the Bachelor of Science Degree is 15 units. Credit accumulated beyond the published distribution requirements shall be accomplished by the addition of “free elective” work.

8. **Physical Education** (See page 166) Qualification in physical education shall be established by completing 1/3 unit of course work (four PE classes) or its equivalent. Such an equivalent, for example, may be participation in club or varsity sports.
PLANNING FOR PROFESSIONAL DEVELOPMENT

To prepare fully for the challenges of professional work and further education, during the normal 16 terms (i.e., four years) of residency, WPI students should make the most of the many important and exciting educational programs available under the Plan in addition to the formal degree requirements as stated above. Therefore, from the beginning of their education at WPI, all students should consider seriously the following key activities which can enrich the basic program (see below):

- Courses or projects taken to prepare for the IQP.
- Projects taken to explore new fields of interest.
- Participation in one of WPI’s foreign exchange programs or international project centers.
- Study in areas of management, economics, or law.
- Expansion of project depth in the IQP or MQP areas.
- Additional advanced courses in your own and related fields, including graduate courses.
- Participation in the WPI B.S./M.S. program—an excellent gateway to the M.S. degree.
- Exploration of that “other area” of science, computer science, or engineering that you always wondered about.
- Double majors involving both technical and nontechical fields.
- Special programs of study for Entrepreneurship.
- Pursuit of a minor in an area of interest.

The opportunities at WPI are extraordinary for those who wish to develop the full degree of professional depth and educational breadth which are the hallmarks of WPI’s education.

Students are strongly encouraged to discuss the advantages of graduate study with their departmental advisors in the sophomore, junior, and senior years. Excellent opportunities exist to integrate upper level courses with graduate study at WPI through the WPI combined B.S./M.S. program described on pages 74, 106, 143, 171 and 257.

THE PLANNING PROCESS

At WPI, students, with the aid of their advisors, structure their own academic programs within the guidelines of the program distribution requirements. Thus, examples of specific programs presented in this catalog do not have to be followed literally. There can be as many different individual programs as there are students, provided the distribution requirements designated for that program are followed.

An undergraduate program should avoid premature over-specialization. Students must obtain a firm, rigorous understanding of the fundamental concepts of their disciplines. An acquaintance with an aspect of state-of-the-art technology is often best achieved through the MQP. Concentrating too soon on changing technological specialties will deprive students of the broad background necessary to educate themselves in new areas as they emerge. Students in engineering, for example, must obtain a firm grounding in mathematics and science, as well as the engineering sciences. Some study in at least one other area of engineering outside the major field is highly valuable for professional practice.

The IQP should be integrated carefully with your overall program, especially the social science requirements. Establish your plans early to take advantage of exciting opportunities WPI offers, at home or abroad. (IQP and exchange opportunities are discussed annually in the fall.)

Information on programs can come from many sources: advisors, other faculty, other students, professionals in the field. As soon as possible in the first year, students will discuss their academic goals with their advisor and plan a general academic program for their entire residence at WPI. If changes in details or even major goals occur, students can integrate them into a cohesive educational pattern which can maximize WPI’s unique program. As students mature, their confidence about making decisions for their own education will grow, too. Indeed, accepting responsibility for program planning is a major and exciting educational effort. Students consult with their advisors, but the final responsibility for program construction remains with each student.

Through courses and independent studies in the first two years, students should sample, explore, and learn the basic concepts of the disciplines necessary to their academic goals. This exploration and sampling will provide, first, a base of knowledge to build upon for further learning; and second, an insight into their basic interests for educational development.

In the latter portion of the academic program, students have the opportunity as they mature to explore, in some depth, specific areas within their disciplinary interests. These experiences should develop ability in self-learning and should involve a significant scholarly effort. Students should strive to learn how to educate themselves from a base of fundamental concepts so that they can develop in new intellectual areas throughout their lifetime.

PROFESSIONALLY ACCREDITED PROGRAMS

WPI is accredited as an institution by the New England Association of Schools and Colleges. In addition, a number of major areas are accredited within their specific disciplines. Seven majors at WPI are accredited by the Engineering Accreditation Commission of ABET. These majors are biomedical engineering, civil engineering, chemical engineering, electrical and computer engineering, industrial engineering, mechanical engineering, and manufacturing engineering. Computer Science is accredited by the Computing Accreditation Commission of ABET. Please note that some departments bearing those particular names may also grant designated majors through their programs that are not ABET accredited (e.g., Sanitary Engineering). The titles of majors are carried on the students’ transcripts and have a bearing on engineering licensing and other professional activities.
Programs other than biomedical engineering, civil engineering, chemical engineering, computer science, electrical and computer engineering, industrial engineering, mechanical engineering, and manufacturing engineering are not ABET accredited.

The program distribution requirements reflect the ABET guidelines for these programs; see pages 27-33 for a review of these guidelines.

Projects and courses carry the same credit weight in establishing all distribution levels. Establishing some engineering breadth and technical literacy outside one’s own field is an important element in establishing a versatile background for an unknown future.

The Chemistry and Biochemistry Department and its program at WPI are approved by the American Chemical Society for a major in chemistry. Those chemistry majors who complete a program satisfying the guidelines established by the American Chemical Society are certified to that organization as having received an undergraduate professional education in chemistry.

The undergraduate and graduate business offerings in the Department of Management are accredited by AACSB International, the Association to Advance Collegiate Schools of Business. AACSB International is a not-for-profit organization consisting of more than 900 educational organizations and corporations. Its mission is excellence in management education in colleges and universities. Headquartered in St. Louis, AACSB International is the premier accrediting agency and service organization for business schools.

ACADEMIC ADVISING

As a student, you have the responsibility of choosing your own program of studies. Your advisor can inform you of available academic alternatives. While your advisor will be willing to suggest specific study programs, he or she will not insist that you follow a particular course of study. By the end of the first semester, you and your advisor should agree upon a tentative four-year academic plan.

A successful advising program is based on a cooperative and understanding relationship between student and advisor. Consult your advisor regularly. Drop in and tell your advisor how the term is going. If you add or drop a course, you should notify your advisor. Many advisors post office hours during which they are available for conversation. If you cannot find your advisor in his or her office, leave a note with the appropriate departmental secretary, indicating your wish to make an appointment; in that note, indicate several times when you could meet with your advisor and also indicate the means by which you can be contacted. Above all, do not hesitate to call or e-mail your advisor on campus, to ask questions, or to arrange for an appointment.

FIRST-YEAR ADVISING (PRE DECLARATION OF MAJOR)

Under WPI's Insights Program, first year students are advised by a small number of faculty academic advisors who make a real commitment to working with groups of students, usually in their residence halls. New students are assigned an Insight advisor who advises a group of 25 to 30 students. These advisors represent all the departments and programs at WPI, and in many cases are the senior faculty members and the most experienced advisors. At WPI, first year advising is much more about mentoring students and much less about course scheduling. Each group is also assigned a peer advisor whose main role is to assist the academic advisor. At the end of the first semester, in December, students officially declare their majors and are assigned an advisor from the department of the declared major.

UPPERCLASS ADVISING

During December or January of the first year, most first-year students wish to be assigned to a new advisor in their major areas of study. Forms to change advisors can be obtained from the office of the Director of Academic Advising at any time during the academic year.

The determination of an appropriate four-year program requires considerable thought and information. Not only your advisor but also departmental consultants, the Projects Office, and the consultants in the Humanities and Arts Department can provide you with assistance in planning for both qualifying projects and a Sufficiency area.
Guidelines for the construction of the most common major programs are given alphabetically by area in the “Department and Program Descriptions” section beginning on page 64. The exact program of study for any student, however, is developed by the student with the aid of an advisor.

Please note that only areas of study which are accredited at WPI by ABET are biomedical engineering, civil engineering, chemical engineering, computer science, electrical and computer engineering, industrial engineering, mechanical engineering, manufacturing engineering, or subareas within those disciplines where appropriate as listed below. For further discussion of accredited degrees, see “Professionally Accredited Programs” on page 22.

The WPI student is not restricted to a major whose name coincides with a department name. Under the WPI Plan, students may major in any area in which the WPI faculty is competent both to help them learn and to evaluate their performance on a suitable professional level. Students should not overlook a wide range of possible majors available at WPI in the Social Sciences, Humanities and Arts, Management, and Interdisciplinary Studies areas.

In the examples below, some programs are listed that are developed through the departments indicated in parentheses. In the past, WPI has graduated students in the following fields, but this list should not be interpreted as necessarily putting any restriction on a student’s “major.”

Applied Mathematics (MA)
Actuarial Mathematics (MA)
Biochemistry (CH) (certified by the American Chemical Society)
Biology (BB)
Biomedical Engineering (BME)
Biomedical Sciences (IGSD)
Biotechnology (BB)
Chemical Engineering (accredited by ABET) (CHE)
Chemical Engineering with Biomedical Interests
Chemistry (certified by the American Chemical Society)
Civil Engineering (accredited by ABET)
Computer Science (accredited by ABET)
Computers with Applications (CS)
Construction Management (CE)
Economics (SSPS)
Economics and Technology (SSPS)
Electrical and Computer Engineering
Areas within the ECE major:
Aerospace and Control Systems
Analog Microelectronics
Biomedical Engineering
Communications and Signal Analysis
Computer Engineering
Power Systems Engineering
RF Circuits and Microwaves
Engineering Physics (PH)
Engineering Science (IGSD)
Environmental Policy & Development (SSPS)
Environmental Studies (IGSD)
Fire Protection Engineering* (FPE)

Humanities and Arts (HU)
Concentrations in:
American Studies
Art History/Architecture
Drama/Theatre
Environmental Studies
German Studies
Hispanic Studies
History
Humanities Studies of Science & Technology
Literature
Music
Philosophy
Religion
Writing and Rhetoric
Industrial Engineering (accredited by ABET) (MG)
Interdisciplinary (by arrangement) (IGSD)
International Studies (IGSD)
Management (MG)
Management Engineering (MG)
Management Information Systems (MG)
Manufacturing Engineering (ME; accredited by ABET)
Materials Engineering* (ME)
Mathematical Sciences (MA)
Mechanical Engineering (accredited by ABET) Concentrations in:
Aerospace
Biomechanical
Engineering Mechanics
Mechanical Design
Manufacturing
Materials Science
Thermal-Fluids
Nuclear Science* (IGSD)
Operations Research (MA)
Physics (PH)
Society, Technology & Policy (SSPS)
Statistics/Probability (MA)
Structural and Geotechnical Engineering (CE)
System Dynamics (SSPS)
Technical, Scientific, and Professional Communications (HU or IGSD)
Transportation Systems (CE)

*Usually combined with MS major programs.

Programs for students interested in medicine, law or pre-college education can be readily developed from many of the above majors.

Interdisciplinary (individually-designed) majors (ID) may also be developed; see Interdisciplinary Programs, page 132.

WPI undergraduate diplomas designate “Bachelor of Science” for all students. The transcript will list the student’s major. If a specialization was completed, this will also be included on the transcript. For example, an entry of “Electrical Engineering with Biomedical Interests” could be made for a student whose course spectrum and qualifying projects substantiate that orientation.

The number of majors associated with a single WPI Bachelor of Science degree is limited to two.
DEFINITION:
A Concentration is an option associated with a Major which provides recognition for focused and coordinated academic work either within the Major or within an area of study closely related to the Major.

RULES:
1. All Concentrations require completion of two units of integrated academic study plus an MQP with a topic and content appropriate to the given Concentration.
2. Concentrations deemed to belong exclusively or primarily within the stated Major must be accommodated within the distribution requirements of that Major.
3. Concentrations deemed to have a substantial interdisciplinary nature can exceed the normal 10-unit allotment of the Major by as much as 1 unit, provided that the additional requirements do not include or permit academic work designated by the Major prefix or coursework normally taken to satisfy the Major’s portion of the distribution requirements. Furthermore, Concentrations of an interdisciplinary nature are permitted to use up to 1 unit of the academic program beyond the distribution requirements of the Major, including the IQP, Sufficiency, Social Science requirement, and Free Electives, as deemed appropriate.
4. The requirements of the Concentration must be designed to offer choices for the student within the Major area and, if relevant, outside the distribution requirements of the Major; however, the Concentration requirements must not preclude meeting the normal distribution requirements for the Major.
5. Rules and guidelines for each Concentration will be formulated by the faculty associated with the governing Major, and must be reviewed by the Committee on Academic Operations (CAO) and subsequently approved by the Faculty. CAO is empowered to rule on whether a proposed Concentration is disciplinary or interdisciplinary.
6. An individual program of study leading to a Major with a Concentration will be planned by a student in consultation with his/her academic advisor. The student’s intention to pursue a Concentration will be declared by application to the appropriate Program Review Committee in accordance with that Committee’s schedule of deadlines. Application deadlines should be designed to enable Committee review and communication of decisions to students at a sufficiently early point that flexibility of schedule still exists. Extenuating circumstances may be considered at the discretion of the Program Review Committee.
7. Concentrations and minors are additional degree designations. Any credit earned for an additional degree designation must not overlap with credit earned for another additional degree designation by more than one unit. Also, no credit-bearing activity may be triple-counted towards degree designations or degree requirements.

Listings of Concentrations may be found in the “Department and Program Descriptions” section beginning on page 64.

MINORS

DEFINITION:
A Minor is a thematically-related set of academic activities leading to a degree designation in addition to but separate from that granted by the Major. A Minor should be available to students of any Major, with the exception of a Minor which overlaps with a Major area to such an extent that it is not sufficiently distinct from that Major. The Committee on Academic Operations (CAO) is responsible for the review of proposed Minor Programs and decisions regarding allowed Major/Minor combinations.

RULES:
1. A Minor requires completion of two or more units of thematically related activity. The concluding 1/3 unit of the Minor must be a capstone experience that marks completion of the Minor.
2. It is expected that Minor requirements will be structured so that all acceptable Major/Minor combinations can be accommodated within a normal 16 term framework.
3. A Minor may include any portion of the academic program, excluding the MQP and the final Type 5 IS/P of the Sufficiency. Academic activities used in satisfying the regular degree requirements may be double-counted toward meeting all but one unit of the Minor requirements, subject to the following restrictions:
   a. The first unit of double-counted work may include at most 1/3 unit of the IQP, 3/3 units of the Sufficiency (excluding the final Type 5 IS/P), or a combination thereof.
   b. At least one unit of the Minor, including the capstone activity, must be free elective choices.
4. The Program Review Committee for a Minor area will consist of faculty members designated by the sponsoring faculty members.
5. A Minor area must be proposed by a sponsoring group of faculty and must be defined by the purpose of achieving an educational goal beyond those apparent or implicit in the regular degree requirements. Student-initiated Minor Programs must be developed with the approval of a sponsoring group of faculty advisors. Each Minor Program must be reviewed by CAO for its individual merit.
6. Concentrations and minors are additional degree designations. Any credit earned for an additional degree designation must not overlap with credit earned for another additional degree designation by more than one unit. Also, no credit-bearing activity may be triple-counted towards degree designations or degree requirements.
An option for some students who wish to broaden their WPI experience is the completion of two distinct majors through the double major option. The choice to pursue a double major should be made early in a student’s career. The limit on the number of majors that a student may complete per degree is two.

Students are reminded that WPI offers only one undergraduate degree. Each graduating undergraduate student receives only one diploma, which reads “Bachelor of Science.” For double majors, the diploma may list both majors (in order of preference by the student), either major, or no major as indicated by the student.

The following modifications are made to the degree requirements for students who elect to pursue a double major:

1. **THE SUFFICIENCY.**
   If a major requires the completion of a humanities and arts sufficiency, satisfactory completion of an MQP in Humanities & Arts or International Studies shall satisfy the humanities and arts sufficiency requirement.

   If a major requires completion of a technical sufficiency, satisfactory completion of an MQP in a science, engineering, or mathematics discipline shall satisfy the technical sufficiency requirement.

2. **THE INTERACTIVE QUALIFYING PROJECT.**
   If a major is in Social Science and Policy Studies, a single project bearing at least one unit credit may be used to satisfy both the MQP requirement for the SSPS major and the IQP requirement. In order to be used to satisfy both requirements, the combined social science MQP and IQP must meet the goals of both projects. It must be interactive in nature involving an aspect of technology, and must also be an application of social science knowledge and analytical techniques. In order to select a single project that satisfies both the goals of the MQP and the goals of the IQP, the decision to pursue a social science double major needs to be made fairly early in the student’s career.

3. **THE MAJOR QUALIFYING PROJECT.**
   At least one separate and distinct major qualifying project of at least one unit of work must be completed for each major.

4. **DISTRIBUTION REQUIREMENTS.**
   The distribution requirements for each major must be met, but requirements common to both majors only need to be satisfied once. Students pursuing multiple majors, concentrations, and/or minors should also consult the rule on Credit Overlap for Degree Designations and Requirements (page 238). The requirements for each individual major must be completed and certified by the Program Review Committee of the department offering that major.

   Some departments offer more than one major. A degree may not include more than one major course of study from the same department unless provided for in the list of exceptions below.

   Exceptions:
   - A student may major in Industrial Engineering and also in either Management, Management Engineering, or Management Information Systems.
   - A student may major in Chemistry and also in Biochemistry.
   - If a student wishes to complete two Interdisciplinary (Individually-Designed) Major Programs, the double major must be proposed in a single Educational Program Proposal which must be approved by the student’s Program Advisory Committee for each major. The Committees shall ensure that the majors are substantially non-overlapping.

**OTHER PROVISIONS.**
If a student’s double major includes an Interdisciplinary (Individually-Designed) Major Program, the double major must be described in the Educational Program Proposal for the Interdisciplinary Major.
The distribution requirements for students who have matriculated before May, 2005 (if different from the requirements printed below) are listed in the individual program descriptions beginning on page 64.

The normal period of residency at WPI is 16 terms. In addition to the WPI requirements applicable to all students (see page 21), distribution requirements apply to 10 units of study in specific areas as listed on the following pages:

### ACTUARIAL MATHEMATICS Minimum Units

1. Mathematics (including MQP) (See notes 1-6). 7
2. Management (See note 7). 4/3
3. Additional courses or independent studies (except MS, PE courses, and other degree requirements) from any area (See note 8). 5/3

**NOTES:**
1. Must include MA 3831 and MA 3832, or their equivalents, at least one of MA 3257, MA 3457, or equivalent, and at least one of MA 3631, MA 4632, or equivalent.
2. Must include two of the following: MA 2073, MA 2271, MA 2273, MA 2431, MA 2631, or their equivalents.
3. Must include three of the following: MA 3211, MA 3212, MA 4213, MA 4214, or their equivalents.
4. May not include independent studies directed toward Society of Actuaries exams.
5. May not include either MA 2201 or MA 2210.
6. May not include both MA 2631 and MA 2621.
7. Must include ACC 2101 and FIN 2200 or their equivalents.
8. Must include 2/3 units of computer science.

### AEROSPACE ENGINEERING Minimum Units

**Requirements**

1. Mathematical and Basic Sciences (Notes 1 and 2) 4
2. Engineering Science and Design (Includes MQP) 6
(Notes 3, 4, 5, 6, 7, 8, 9)

**NOTES:**
1. Must include a minimum of 5/3 units of mathematics including differential calculus and differential equations.
2. Must include a minimum of 3/3 units in physics and 1/3 unit in chemistry.
3. Must include 5/3 units in Aerodynamics and Propulsion with topics in Incompressible Fluid Dynamics, Viscous Flows, Compressible Flows, Aerodynamics, Rocket and Spacecraft Propulsion
4. Must include 3/3 units in Aerospace Structures and Materials with topics in Materials Science, Stress Analysis, and Aerospace Structures
5. Must include 2/3 units in Spacecraft Dynamics and Control with topics in Orbital Mechanics, Spacecraft Dynamics and Control
6. Must include 1/3 units in Aerospace Systems Design that integrates either aeronautical or astronomical topics.
7. Must include 2/3 units in Avionics and Information Systems with topics in Aerospace Avionics Systems.
8. Must include 1/3 Unit of Capstone Design Experience. This Capstone experience can be satisfied by completing an MQP which integrates course work and involves engineering design. At the time of registration for the MQP the project advisor will determine whether the MQP will meet the Capstone Design requirement or not. If not, the advisor will identify an additional 1/3 unit of course work to be taken in order to meet the ABET Capstone Design requirement.
9. Must include 2/3 units of Engineering Science and Design electives.

### BIOCHEMISTRY Minimum Units

1. Mathematics and Physics (Note 1). 2
2. Chemistry and Biochemistry (Note 2). 4
3. Biology (Note 3). 1 2/3
4. Chemistry and Biochemistry/Biology Laboratory (Note 4). 1
5. Other Natural or Computer Science (Note 5). 1/3
6. MQP 1

**NOTES:**
1. The mathematics in MA 1021-MA 1024 or the equivalent is recommended. The physics in PH 1110-PH 1120 or equivalent is recommended.
2. These four units must include one unit of organic, one unit of biochemistry, and 1/3 unit each of physical (3000 level or higher) and inorganic chemistry (3000 level or higher).
3. These 1 2/3 units must include 1/3 unit of cell biology, 1/3 unit of genetics, and 2/3 unit of advanced work (3000 level or higher).
4. This unit must include a minimum of 1/3 unit in Chemistry and Biochemistry, and a minimum of 1/3 unit in Biology.
5. Any course in the natural sciences (not used to satisfy another requirement) or in computer science may be used to satisfy this requirement.

### BIOLOGY/BIOTECHNOLOGY Minimum Units

**WITH A CONCENTRATION (Note 1) Minimum Units**

1. Mathematical Science, Physics, Computer Science, Engineering (see Note 1) 5/3
2. Chemistry 5/3
3. BB 1000/2000-level (see Note 2) 4/3
4. BB Laboratory Experience (see Note 3) 4/3
5. BB 3000/4000-level (see Note 4) 5/3
6. Related Courses (see Note 5) 4/3
7. MQP 1

**NOTES:**
1. BB 3040 may count toward this requirement.
2. Only one BB course at the 1000 level (excluding BB 1001 & 1002) may be counted toward this requirement.
3. Chosen from among BB 2000/3000/4000 Laboratories or from Laboratory Experience List for all BB Concentrations. Must include at least 1/2 unit of course work at the 2000 level.
4. In certain cases, 500-level courses are appropriate for undergraduate credit with explicit permission of the instructor.
5. Chosen from among the Related Courses Lists for all BB Concentrations.
CHEMISTRY

<table>
<thead>
<tr>
<th>Minimum Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mathematics and Basic Science (Note 1)</td>
</tr>
<tr>
<td>2. Chemistry (Note 2)</td>
</tr>
<tr>
<td>3. Additional Science/Engineering (Note 3)</td>
</tr>
</tbody>
</table>

NOTES:
1. Must include differential and integral calculus and at least 2/3 units of physics.
2. Must be above the level of general chemistry (2000 level or higher). These 4 units must include courses in experimental chemistry (either 4/3 unit or 3/3 unit), inorganic chemistry (1/3 unit), organic chemistry (3/3 unit), physical chemistry (3/3 unit), and biochemistry (either 1/3 unit or 2/3 unit, depending on the number of experimental chemistry courses taken). At least 2/3 units must be at or higher than the 4000 level.
3. Distributed among the MQP, the natural and physical sciences, computer science, mathematics, and engineering (and including general chemistry, CH 1010-1040).

CIVIL ENGINEERING

<table>
<thead>
<tr>
<th>Minimum Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mathematics and Basic Science (Notes 1,2).</td>
</tr>
<tr>
<td>2. Engineering Science and Design (including the MQP) (Notes 3,4,5,6).*</td>
</tr>
</tbody>
</table>

NOTES:
1. Mathematics must include differential and integral calculus, differential equations, and probability and statistics.
2. Must include both chemistry and physics with a minimum of one course in physics and two courses in chemistry.
3. A minimum of 4 units of work must be within the Civil Engineering area. All CE courses including the MQP, ES 2503, and ES 3004 are acceptable within the Civil Engineering area.
4. The curriculum must include at least one engineering science course outside the major discipline area. Areas acceptable to satisfy the requirement of outside-of-discipline course are those taught in other engineering departments. The course must be a 2000-level or above and cannot include ES 2501, ES 2502, ES 2503, and ES 3004.
5. All students are required to include an appropriate laboratory experience as part of their overall program. This experience can be met by the completion of two undergraduate CE lab courses, selected from among the following: CE 2020, CE 3024, CE 3026, CE 3054, CE 4046, and CE 4060. Alternatively, an appropriate laboratory experience could also be accomplished by a student through careful planning of course and laboratory work and approval by petition through the Department Program Review Committee.
6. Must include 1/3 unit of Capstone Design Experience.

CHEMICAL ENGINEERING

<table>
<thead>
<tr>
<th>Minimum Units</th>
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</thead>
<tbody>
<tr>
<td>1. Mathematics and Basic Science (Notes 1, 2).</td>
</tr>
<tr>
<td>2. Engineering Science and Design (Notes 3, 4).</td>
</tr>
<tr>
<td>3. Advanced Chemistry (Note 5).</td>
</tr>
</tbody>
</table>

NOTES:
1. Must include differential and integral calculus and differential equations.
2. Must include 2 courses in physics.
3. Must include 1 unit of MQP, 1/3 unit of capstone design experience (e.g., CHE 4404), and at least 1/3 unit of engineering study outside the major. Courses used to satisfy this requirement must be at the 2000-level or above, with the exception of CHE 1011.
4. Must include at least 4 units from the following list of core chemical engineering courses: CHE 2011, CHE 2012, CHE 2013, CHE 2014, ES 3004, ES 3003, ES 3002, CHE 3201, CHE 3501, CHE 4401, CHE 4402, CHE 4403, CHE 4404, CHE 4405.
5. All CH courses qualify except CH 1010, CH 1020, and CH 1030 which are basic science. Up to 1 unit of Advanced Chemistry may be double counted as both Advanced Chemistry and Basic Science. One course of Advanced Natural Science (2000 level and above BB, PH, GE) may be substituted for one Advanced Chemistry course.
c. At least 5/3 units of the Computer Science requirement must consist of 4000-level courses. These units can also be met by WPI graduate CS courses, with the exception of CS 501 and CS 507.
d. Only one of CS 1101 and CS 1102 may count towards the computer science requirement. Only one of CS 2301 and CS 2303 may count towards the computer science requirement.
2. A cross-listed course may be counted toward only one of areas 1, 2, 3, above.
3. Must include at least 1/3 unit from each of the following areas: Probability (MA 2621, MA 2631) and Statistics (MA 2611, MA 2612).
4. Courses satisfying the science requirement must come from the BB, BME, CE, CH, CHE, ECE, ES, GE, ME, PH disciplines. At least three courses must come from BB, CH, GE, PH, where at least two courses are from one of these disciplines.
5. At most four 1000-level Mathematics courses may be counted towards this requirement.

<table>
<thead>
<tr>
<th>MINIMUM DISTRIBUTION REQUIREMENTS FOR STUDENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COMPUTERS WITH APPLICATIONS</strong></td>
</tr>
<tr>
<td>1. Computer Science (including the MQP) (Notes 1, 2).</td>
</tr>
<tr>
<td>2. Mathematics (Note 2).</td>
</tr>
<tr>
<td>3. Basic Science (Notes 2, 3).</td>
</tr>
<tr>
<td>4. Application Area (Notes 2, 4).</td>
</tr>
<tr>
<td><strong>NOTES:</strong></td>
</tr>
<tr>
<td>a. Only CS 1101, CS 1102 and computer science courses at the 2000-level or higher will count towards the computer science requirement. CS 2118 will not count towards the computer science requirement.</td>
</tr>
<tr>
<td>b. Must include at least 1/3 unit from each of the following areas: Systems (CS 3013, CS 4513, CS 4514, CS 4515), Theory and Languages (CS 3133, CS 4123, CS 4533), Design (CS 3041, CS 3431, CS 3733, CS 4233), and Social Implications of Computing (CS 3043, SS 2208). (If SS 2208 is used to satisfy this requirement, it does not count as part of the 16/3 units of CS.)</td>
</tr>
<tr>
<td>c. At least 5/3 units of the Computer Science requirement must consist of 4000-level courses. These units can also be met by WPI graduate CS courses, with the exception of CS 501 and CS 507.</td>
</tr>
<tr>
<td>d. The MQP must involve the application of computer science concepts to the Application Area specified in Requirement 4.</td>
</tr>
<tr>
<td>e. Only one of CS 1101 and CS 1102 may count towards the computer science requirement. Only one of CS 2301 and CS 2303 may count towards the computer science requirement.</td>
</tr>
<tr>
<td>2. A cross-listed course may be counted toward only one of areas 1, 2, 3, 4 above.</td>
</tr>
<tr>
<td>3. The two courses satisfying the science requirement must both come from one of the following disciplines: BB, CH, GE, PH.</td>
</tr>
<tr>
<td>4. This requirement is satisfied by a cohesive set of work from disciplines other than Computer Science. Work used for any other degree requirements cannot be used for the Application Area. At least 3/3 units must be course work at the 3000 level or higher. Independent Study/Project (ISP) work, if any, must be conducted under the supervision of a member of the faculty in that discipline.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMPUTER ENGINEERING Minimum Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mathematics and Basic Science (Notes 1a-1d).</td>
</tr>
<tr>
<td>2. Engineering Science and Design (ES/D) (including the MQP) (Notes 2a-2g).</td>
</tr>
<tr>
<td><strong>NOTES:</strong></td>
</tr>
<tr>
<td>1. Mathematics and Basic Science:</td>
</tr>
<tr>
<td>a. Must include at least 7/3 units of math (prefix MA).</td>
</tr>
<tr>
<td>Mathematics must include differential and integral calculus, differential equations, discrete mathematics, and probability and/or statistics.</td>
</tr>
<tr>
<td>b. Must include at least 2/3 units of physics (prefix PH).</td>
</tr>
<tr>
<td>c. Must include at least 1/3 units of chemistry (prefix CH) or 1/3 units biology (prefix BB).</td>
</tr>
<tr>
<td>d. Must include an additional 2/3 units of math or basic science (prefixes MA, PH, CH, BB, or GE).</td>
</tr>
<tr>
<td>2. Engineering Science and Design (including the MQP):</td>
</tr>
<tr>
<td>a. Must include at least 5 units within the Electrical and Computer Engineering area (including the MQP). All courses with prefix ECE (except ECE 3601) are applicable</td>
</tr>
</tbody>
</table>
to these 5 units. Also, courses ES 3011, BME 4011, and BME 4201 are applicable to these 5 units.
2b. The 5 units within the Electrical and Computer Engineering area must include at least 1 unit of courses from an approved list of Electrical Engineering courses (see page 116)
2c. The 5 units within the Electrical and Computer Engineering area must include at least 2/3 unit of courses from an approved list of Computer Engineering courses (see page 116)
2d. The 5 units within the Electrical and Computer Engineering area must include 1/3 unit of Capstone Design Experience. (This requirement is typically fulfilled by the MQP.)
2e. Must include at least 1/3 unit of computer science (prefix CS), at the 2000 level or above (other than CS 2011, CS 2022, CS 3043 which cannot be applied to this requirement).
2f. Must include at least 1/3 unit of engineering science (prefix ES) at the 2000 level or above. This requirement may also be satisfied by ME 3601. ES 3011 cannot be applied to this requirement.
2g. Must include an additional 1/3 unit of engineering science and design at the 2000 level or above, selected from courses having the prefix BME, CE, CHE, CS (other than CS 2011, CS 2022, CS 3043), ECE (other than ECE 3601), ES, FP, or ME.

### ENVIRONMENTAL POLICY AND DEVELOPMENT

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Minimum Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SS &amp; PS (Note 2)</td>
<td>12/3</td>
</tr>
<tr>
<td>2. Mathematics (Note 3)</td>
<td>5/3</td>
</tr>
<tr>
<td>3. Basic Science (Note 4)</td>
<td>2/3</td>
</tr>
<tr>
<td>4. Technical Concentration (Note 5)</td>
<td>2</td>
</tr>
<tr>
<td>5. Department Electives (Note 6)</td>
<td>2/3</td>
</tr>
<tr>
<td>6. MQP</td>
<td>1</td>
</tr>
</tbody>
</table>

**NOTES:**
1. 1/3 unit = 1 course. 15 units are required for graduation.
2. Students must complete 5/3 units (5 courses) in one of three social science areas: (a) economics, (b) psychology/sociology, (c) political science (includes SS & PS courses in law and policy analysis) and 2/3 unit (2 courses) in each of the other two social science areas. The particular courses chosen must include six out of the following nine courses: A Psychological Perspective on Environmental Problem Solving, American Public Policy, Development Economics, Environmental Economics, International Environmental Policy, Introduction to System Dynamics Modeling, Environmental Policy and Law, Technical Expertise in Governmental Decision Making, and the Society-Technology Debate. Students must also complete three other social science courses (1 unit) of their choosing.
3. Must include both calculus and statistics.
4. Basic science courses must be selected from the disciplines of Physics, Chemistry, or Biology.
5. The technical concentration must include at least six thematically related courses in science, engineering or management that have been approved by the Department’s Program Review Committee.
6. Departmental electives must be selected from the areas of mathematics, basic science, social science, or the technical concentration.

### HUMANITIES AND ARTS

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Minimum Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Humanities and Arts (including MQP) (Note 1)</td>
<td>6</td>
</tr>
<tr>
<td>2. Electives (Note 2)</td>
<td>4</td>
</tr>
</tbody>
</table>

**NOTES:**
1. Humanities and Arts majors may choose to complete 2 units of work and an MQP in one of the following areas of Concentration: History, Literature, Music, Philosophy, Religion, Drama/Theatre, Writing and Rhetoric, Art History/Architecture, German Studies, Hispanic Studies, American Studies, Environmental Studies, or Humanities Studies of Science and Technology.
2. May be from any area except Aerospace Studies, Military Science, or Physical Education. Courses used to satisfy other degree requirements (i.e. the IQP and the Sufficiency) may not be used to fulfill this requirement.

### DOUBLE MAJOR IN HUMANITIES AND ARTS

Students may pursue a double major in Humanities and Arts and in an area of science, engineering, or management. To pursue the double major, a student must satisfy all of the degree requirements of the technical discipline including an MQP and Distribution Requirements. In addition, the double major in Humanities and Arts requires 6 units of studies in the Humanities and Arts, including the MQP. Students pursuing a double major in Humanities and Arts are not required to complete a Sufficiency Program in Humanities and Arts, nor are they required to complete a second IQP. Students interested in pursuing this option should contact Prof. B. Addison, 39 Dean St., Room 260, for additional information.

### INDUSTRIAL ENGINEERING (Management Department)

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<th>Requirement</th>
<th>Minimum Units</th>
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<td>1. Mathematics and Basic Science (Notes 1, 2)</td>
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<tr>
<td>2. Industrial Engineering Topics (including the MQP) (Notes 3, 4)</td>
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</table>

**NOTES:**
1. Mathematics must include differential and integral calculus, ordinary differential equations, and 2/3 units in probability and statistics.
2. Basic Science must include both chemistry and physics, with a minimum of two courses in either.
3. Must include 1/3 unit of Capstone Design Experience.
4. Industrial Engineering Topics must include courses in the following three topic areas.
   a. 3 units of industrial engineering core courses, including 1/3 unit in each of the following 9 areas: engineering basics outside industrial engineering, deterministic operations research methods, process design, production planning and control, simulation, stochastic methods in operations research, information systems design, financial modeling and organizational science.
   b. 1 unit in Industrial Engineering electives, 3000/4000 level OIE courses, MIS 3720, MIS 4720, and Operations Research courses in Mathematics qualify. Courses in financial modeling and organizational science do not qualify.
   c. 1 unit in technical electives. Industrial Engineering electives and any other Engineering Science/Design courses qualify.
INTERDISCIPLINARY
By individual arrangement; see page 132.
### MANAGEMENT (MG, MGE, MIS) Minimum Units
1. Management Foundation (Note 1) 11/3
2. Mathematics (Note 2) 4/3
3. Basic Science 2/3
4. Management Major (Note 3) 6/3
5. Management Electives (Note 4) 3/3
6. Computer Science (Note 5) 1/3
7. MQP 3/3
(Note 6)

**NOTES:**
1. The Management Foundation must cover the foundation knowledge in the management functional areas, including at least 1/3 unit of financial accounting, managerial accounting, financial management, organizational science, deterministic management science, operations management, marketing management, information systems management, microeconomics, macroeconomics, and business law and ethics.
2. Mathematics must include 2/3 units of calculus and 2/3 units of statistics.
3. The Management Majors (other than IE) must comprise a department-approved integrated set of courses covering a specific area of: management, science, engineering or mathematics for MGE; computer science or information systems for MIS; management, social sciences, or humanities for MG.
4. Management electives must include at least 1/3 unit from among the 3000- and 4000-level courses in the Department. The remaining 2/3 units specified in the requirement may be satisfied with courses from Mathematics, Basic Science, Computer Science, Social Science, or courses with any of the following prefixes: ACC, BUS, ETR, FIN, MIS, MKT, OBC, or OIE, but excluding courses FIN 1250 and OIE 2850.
5. A minimum of 1/3 unit of Computer Science (except CS 2022 and CS 3043). Either CS 1101 or CS 1102 is recommended.
6. Courses may not be counted more than once in meeting the departmental distribution requirements. The total number of units taken in the Department of Management may not exceed 50% of the total number of units earned for the degree.

### MANUFACTURING ENGINEERING Minimum Units
1. Mathematics and Basic Science (Notes 1, 2). 4
2. Engineering Science and Design (including the MQP) (Note 3, 4). 6

**NOTES:**
1. Mathematics must include differential and integral calculus and differential equations.
2. Science must include both chemistry and physics with a minimum of two courses in either.
3. At least one unit from each of the following areas is required:
   A. Materials and Processes
   B. Product Engineering and Tool Design
   C. Computer Control and Manufacturing Systems
   D. Production Systems Engineering
   4. Must include 1/3 unit of Capstone Design Experience.

### MECHANICAL ENGINEERING Minimum Units
1. Mathematics and Basic Science (Notes 1, 2, 3). 4
2. Engineering Science and Design (includes MQP) (Notes 3, 4, 5, 6, 7, 8, 9). 6

**NOTES:**
1. Must include a minimum of 5/3 units of mathematics, including differential and integral calculus and differential equations.
2. Must include a minimum of 1/3 unit in chemistry and 2/3 unit in physics, or 1/3 unit in physics and 2/3 unit in chemistry.
3. Must include an activity that involves basic matrix algebra and the solution of systems of linear equations, and an activity that involves data analysis and applied statistical methods.
4. Must include 1/3 unit in each of the following: electrical engineering, materials science, and mechanical engineering experimentation.
5. Must include at least one unit of ME courses at the 4000-level or higher.
6. May include 1000 level courses only if designated ES or ME.
7. Must include two stems of coherent course and/or project offerings as noted below in a and b.
   a. A minimum of one unit of work in thermofluid systems that includes the topics of thermodynamics, fluid mechanics and heat transfer, plus an activity that integrates thermofluid design.
   b. A minimum of one unit of work in mechanical systems that includes the topics of statics, dynamics, and stress analysis, plus an activity that integrates mechanical design.
8. Must include an activity which realizes (constructs) a device or system.
9. Must include 1/3 unit of Capstone Design Experience.
   Items 3, 5, 7a integration, 7b integration, 8, 9 may all be “multiple-counted.”

### PHYSICS Minimum Units
1. Mathematics (Note 1). 3
2. Physics (including the MQP) (Notes 2, 3). 5
3. Other subjects to be selected from mathematics, science, engineering, computer science, and management (Note 3). 2

**NOTES:**
1. Mathematics must include at least 2/3 unit of mathematics at the level of MA 3000 or higher.
2. ES 3001 and CH 3510 count as physics courses.
3. Either item 2 or 3 must include at least 1/3 unit from each of the five principal areas of physics: mechanics, experimental physics, electromagnetism, quantum mechanics, and thermal and statistical physics. This core distribution requirement is satisfied by successfully completing at least one course from each of the following five sets of courses: PH 2201 or 2202 (mechanics); PH 2651 or 2601 (experimental physics); PH 2301 or 3301 (electromagnetism); PH 3401 or 3402 (quantum mechanics); ES 3001, CH 3510, or PH 4206 (thermal and statistical physics); or other courses approved by the department Program Review Committee following petition by the student.
ENGINEERING PHYSICS
1. Same requirements as PHYSICS, with the addition that the 10 units must include 2 units of coordinated engineering and other technical/scientific activities. The 2-unit program must be formulated prior to final year of study by the student in consultation with the academic advisor, and must be certified prior to the final year by the departmental Program Review Committee.

These distribution requirements in physics apply to all students matriculating at WPI after May, 2005. Students who matriculated prior to May, 2005, have the option of satisfying the degree requirements in the catalog current at the time of their matriculation.

SOCIETY, TECHNOLOGY and POLICY  Minimum Units
1. Social Science (Notes 1, 2). 4
2. Minimum Basic Science background. 2/3
3. Minimum Mathematics background (Note 3). 1
4. Technical concentration (Note 4). 5/3
5. Electives (Note 5). 5/3
6. MQP 1

NOTES:
1. Students must obtain approval of their proposed program from the Departmental Program Review Committee. Course distribution will focus on a disciplinary specialty and either policy analysis or a society-technology specialization such as Social Impact Analysis or Technology Assessment.
2. Relevant Humanities and Arts or Management courses approved by the Departmental Review Committee may be counted for a maximum of 2/3 of a unit in fulfilling the 4-unit requirement.
3. One course in calculus-based statistics is required.
4. A series of courses in one field of science, engineering, or management or a combination of courses approved by the Departmental Review Committee which focus on issues to be developed in the MQP.
5. These courses are to be approved by the Departmental Review Committee and are meant to broaden the technical concentration and tie it to social concerns.

SYSTEM DYNAMICS  Minimum Units
1. System Dynamics (Note 1) 5/3
2. Other Social Science (Note 2) 5/3
3. Management (Note 3) 2/3
4. Mathematics/basic sciences/engineering (Note 4) 8/3
5. Computer Science (Note 5) 2/3
6. Application Area (Note 6) 5/3
7. MQP 1

NOTES:
1. Only social science courses with a “5” in the second digit of the course number count toward the system dynamics requirement.
2. Must include microeconomics or macroeconomics, cognitive or social psychology, and public policy.
3. Must include organizational science.
4. Must include differential and integral calculus, differential equations, and numerical analysis or statistical analysis.
5. Courses on computer programming and programming languages are recommended.
6. This requirement is satisfied by a cohesive set of work from the fields of social science, management, science, mathematics, computer science, or engineering as specified in the curriculum the guidelines for system dynamics major.

TECHNICAL, SCIENTIFIC, AND PROFESSIONAL COMMUNICATION  Minimum Units
1. Scientific and/or technical concentration (Note 1) 6
2. Writing and Rhetoric concentration (Note 2) 3
3. MQP 1

NOTES:
1. The student’s scientific and/or technical concentration must be a plan of study, approved by the student’s program review committee, with a clear underlying rationale in mathematics, basic science, computer science, engineering, and/or management.
2. The Writing and Rhetoric concentration consists of 1 unit in each of the 3 following categories of courses. Courses taken to fulfill these distribution requirements will not include courses that fulfill other degree requirements, such as the Humanities and Arts Sufficiency and the Social Sciences requirement. Exceptions to this restriction, not to exceed 1 unit, must be approved by the student’s program review committee, and will be granted only under unusual circumstances.

A. Written communication (1 unit)
   Recommended courses:
   EN/WR 2211  Elements of Writing
   EN/WR 3011  Peer Tutoring in Writing
   EN/WR 3214  Writing About Disease and Public Health
   EN/WR 3216  Writing in the Professions or equivalent writing courses or ISPs

B. Rhetoric and communication studies (1 unit)
   Recommended courses:
   RH 3111  The Study of Writing
   RH 3112  Rhetorical Theory
   RH 3211  Rhetoric of Visual Design or ISP or any of the courses listed in Category A not used to fulfill that requirement.

C. Electives (1 unit)
   The 1 unit of electives must be coherently defined and approved by the student’s program review committee.
   Students may draw on:
   Courses in science, technology, and culture studies (such as AR/ID 3150, CS 3041, CS 3043, EN 2252, EN 3235, HI 2331, HI 2332, HI 2333, HI 2334, HI 3331, SS 2207, SS 2208, or SS 2302): Philosophy and ethics courses (such as PY 2711, PY 2713, PY 2714, PY 2716, PY 2717, PY/RE 2731, PY/RE 3731); Foreign language courses; Management courses.
PROJECTS

COURSES QUALIFYING FOR ENGINEERING DISTRIBUTION AREAS

Mathematics
All Courses designated “MA.”
Advanced placement established by AP exam or through passing WPI advanced courses (see page 261) also qualify.

Basic Science
All courses designated “PH,” “CH,” “BB,” and GE 2341.

Engineering Science/Design
The following courses may be applied to the “Engineering Science and Design” distribution requirement for each respective engineering major:
BME: All courses designated “BME” (except BME 3110) and CE, CHE, ECE, and ME courses at the 2000-level or above.
CE: All courses designated “CE”. Also ES 2503 and ES 3004.
CHE: All courses designated “CHE.” Also ES 3002, ES 3003, ES 3004, and other courses approved by the Chemical Engineering Department. See page 96, and consult with your academic advisor for details.
ECE: All courses designated “ECE” except ECE 3601. Also ES 3011, BME 4011, and BME 4201 may be included in the six-unit ECE area distribution requirement.
ME: All courses designated “ME” except ME 3601.
IE: OIE courses including OIE 2500, OIE 3401, OIE 3405, OIE 3420, OIE 3450, OIE 3460, OIE 3501, OIE 4410, and OIE 4460.

In addition, engineering majors selecting “Engineering Science/Design” courses from outside their major may choose appropriate activities from any of the following:
All courses designated ES, ECE, CHE, ME.
All OIE courses listed above (for ME majors only).
All courses designated as CE except CE 3022.
All courses designated as CS except CS 1101, CS 1102, and CS 3043.
(Electrical and Computer Engineering majors are restricted to these courses at the 2000-level or higher.)
All ABET engineering programs require six units of Engineering Science and Design.

All graduate-level courses may be counted in the appropriate categories.

PAY AND CREDIT
The WPI Faculty approved the following project policies in 1973:
1. A student may receive pay for related work that is above and beyond the work clearly defined for academic credit for a project.
2. Wherever possible remuneration for this extra work will be paid by WPI to the student from funds directly obtained through grants from the company to the college.
3. Results obtained from paid or unpaid work performed while students are not registered for project credit at WPI may be used in projects only after consultation with the project advisor. When possible such consultation should take place before the work begins.
4. Students who wish to pursue project work off-campus for WPI credit can do so only if 1) they are registered for that term at WPI, 2) their project advisors have established appropriate methods of supervising the off-campus work. Such supervision must make adequate provision for periodic review and advising.

PROJECTS

Project activity is an integral part of the educational experience for all students under the WPI Plan. The two types of qualifying projects are:
1. A project in the major field of study (the Major Qualifying Project, or MQP).
2. A project which relates technology and science to society or human needs (the Interactive Qualifying Project, or IQP).

Projects should be chosen in consultation with the student’s academic advisor and must be accepted by a project advisor before project registration can be completed. Many project opportunities come from off-campus organizations, and provide challenges to solve real-world problems and thus gain experience invaluable for seeking jobs and for professional practice. Students are encouraged to develop their own projects, to solicit support for their ideas from potentially interested faculty, and to form teams to pool resources and share points of view.

The Major Qualifying Project should focus on the synthesis of all previous study to solve problems or perform tasks in the major field with confidence, and communicate the results effectively.

The Interactive Qualifying Project should challenge students to relate social needs or concerns to specific issues raised by technological developments.
RESOURCES - GETTING STARTED
Students are encouraged to avail themselves of the many resources and advice areas found in the Projects Program web page (www.wpi.edu/Academics/Projects).

In addition, personal advice can be provided by meeting with the Projects Administrator (Projects & Registrar’s Office–Boynton Hall) or the project coordinators listed on page 244.

AVAILABLE PROJECTS
Students may obtain information about new or ongoing projects from a variety of sources. Principal sources include discussions with other students, especially those currently involved in a project, the Projects Program web site, department offices, or their web pages. Off-campus projects are discussed annually in the fall. In the spring, “Available Projects” on the Projects Program web site (www.wpi.edu/Academics/Projects/) can be used as a directory of specific projects or as a source of ideas for developing your own projects. Some students will find a project listed which fits their needs and interests exactly. In other cases, the listing will serve to lead students to a faculty member with whom project involvement can be negotiated. The proposals in the Projects Program web page are updated periodically to provide an accurate listing of available projects.

PROJECT ADVISOR
Academic advisors can assist students in identifying a project. They are aware of the project interests of many other faculty members, and have a list of faculty interests which will enable a student to find a faculty member who can help to develop a project idea. Faculty associated with the Interdisciplinary and Global Studies Division (IGSD) are available to assist students in interdisciplinary and interactive projects. The Projects & Registrar’s Office can also assist in finding an appropriate project advisor. See pages 245-246.

PROJECT PERFORMANCE
A student is normally expected to expend 15-17 hours per week on the average for each 1/3 unit of credit for project work, and expected achievement is based upon that commitment.

A project group, whether it involves one student or more, should have a minimum of one scheduled conference per week with the advisor(s). Additional time should be scheduled when the effort exceeds 1/3 unit per student or when more students are involved.

Students should be prepared to submit written project reports to the advisor each week. Students are also encouraged to complete a proposal at the beginning of the project activity to define the scope and timeline for completion of the effort. In addition, oral reports may be required as determined by the advisor. At the end of the project, a report must be prepared to the satisfaction of the project advisor. For projects sponsored by off-campus organizations, both a written and oral report for the sponsors is normally expected. Written qualifying project reports go on file in Gordon Library for a period of five years.

QUALIFYING PROJECT DOCUMENTATION
In completing the qualifying project degree requirement, students must submit to their project advisors a final document of record. It is expected that the qualifying project documentation will, in most cases, consist of a written report only. In some cases, however, the project documentation may include, in addition to the written report, material in another medium or form, such as software, a video tape, a CD-Rom, or a publication. It is reasonable to expect that the scope of the written report in such instances may be narrower than would be the case if the documentation were by written report only; for example, the objective of a project might be the preparation of a videotape to serve a special purpose, meet a specified need, record a singular event, etc. At the very least, however, the written report portion of the project documentation should provide the reader with a history of the student’s involvement with the project, its aims and objectives, its rationale, the role played in the project by the material in the other medium, and the conclusions reached and recommendations framed by the student. All additional forms of documentation must also be submitted with the written report.

FINAL REPORT PROCEDURES
The student will submit the project documentation (the original copy of the written report plus any additional documentary material) to the project advisor. The deadline for the submission of the initial report draft and the final document may be established at the discretion of the project advisor. Drafts and reports need not be accepted by the advisor after the established deadline.

The qualifying project advisor will fill out the “Completion of Degree Requirement” form and forward both the form and the project documentation to the Registrar. The Registrar will record the completion of the degree requirement and the evaluation grade only if the project documentation accompanies the form. Otherwise, the Registrar will return the form to the initiator. In the case of a group project report, a separate completion form must be submitted for each student.

The student is responsible for the cost of preparing only the original copy of the written report. The cost of additional copies will be borne by the individual or organization desiring them. It is highly recommended that each student retain a copy of their project for future reference.

GROUP QUALIFYING PROJECT EFFORTS
Students meeting a qualifying project degree requirement by participation in a group, or team effort, will submit, at the discretion of the project advisor, either a single, comprehensive written report from the group, or individual written reports from each member of the group. A single, comprehensive written report must, however, include some means by which each individual’s contribution to the group effort may be clearly identified. This identification may take the form of an “authorship page,” simply a
list of individual chapters and their respective authors, or of a prefacing statement in which each contributing group member is named as having carried out one or more specific tasks within the overall project effort.

In the case where one or more students leave an ongoing group project after having contributed at least one unit each of project effort, those students, again at the discretion of the project advisor, will submit either a single written report or individual written reports in satisfying the qualifying project documentation requirement. The same means of identifying individual contributions will be employed as described above.

CENTER FOR COMMUNICATION ACROSS THE CURRICULUM (Upper Level; Project Center)
Accompanying strong emphasis on project work at WPI is strong emphasis on high quality presentation of materials such as proposals, written reports, term papers, and abstracts describing the project work. To assist you in developing your writing and oral presentation skills, WPI has established a Center for Communication Across the Curriculum that offers writing and presentation consultations, style guidelines, writing manuals and presentation videotapes. Style guidelines, writing manuals and specially prepared handouts concerned with report writing are available. Small group or individual conferences scheduled by appointment with the writing consultants constitute an additional service provided by the Center to help students with their writing skills. For further information, contact the Humanities and Arts Department or IGSD.

DISSEMINATION OF PROJECT REPORTS
MQPs and IQPs completed for off-campus agencies are usually distributed within the sponsoring agency by the agency project liaison. MQP and IQP reports are cataloged for reference in the Gordon Library for five years after being submitted to the faculty advisor. After that period, they are returned to the faculty advisor(s).

Students thus must be responsible for keeping personal copies of project reports for their own permanent professional records. WPI strongly encourages students to prepare MQP and IQP reports in electronic as well as hard copy formats. In this way, reports can be reviewed for later use by students, and incorporated into a professional portfolio.

Thus, MQPs and IQPs are best viewed as research reports which establish good professional practices as well as being potential sources for further study and research.

PROJECTS PROGRAM

Project opportunities have been established at industrial, institutional, and governmental organizations. Projects are available in nearly all disciplines. Announcements of off-campus project opportunities are made annually in February.

Students work on problems at the off-campus site in cooperation with site personnel and under the overall supervision of WPI faculty. The WPI project centers feature programs specifically chosen for the educational merit and close relationship to the student’s interest.

Students may participate on a full-time basis. Only students who have demonstrated by acceptable work at WPI the necessary aptitude and sense of responsibility will be approved for study at a center. Students and advisors interested in off-campus project opportunities should contact the Projects Office for further information.

OFF-CAMPUS INSURANCE AND LEGAL AGREEMENTS
WPI’s insurance program includes a broad range of coverage for students doing projects in cooperation with off-campus organizations. This insurance coverage requires proper documentation of individual student participation. All students doing project work with off-campus organizations must complete the pertinent portion of the project registration form. In certain cases, where the project is included as part of a regular course, the course instructor must submit to the Projects Office a list of the students going off campus and the name(s) and address(es) of the organization(s) involved.

WPI has entered into a variety of agreements with off-campus organizations, covering a wide range of issues common to the projects program. Students agree to abide by these agreements during the registration for the project.

PROJECT CENTERS
Each Project Center has a WPI faculty member as the director, well-defined procedures for completing project work, and selective admissions processes. The Centers tend to be highly structured and require superior performance.

At the present time, the WPI project centers close to campus are:
- Gillette Company Project Center.
- Lincoln Laboratory Project Center.
- UMass Memorial Health Care, University of Massachusetts Medical Center, and Tufts School of Veterinary Medicine Project Centers.
- Worcester Community Project Center.

See also page 46 for residential Project Centers at a distance from WPI.
GILLETTE COMPANY PROJECT CENTER

Gillette is the world leader in grooming products. Their South Boston Manufacturing Center (SBMC) is their primary location for the manufacture of shaving systems such as the Mach 3 and Venus razors, where over a billion units are produced each year. Many major qualifying project opportunities are available, principally in mechanical and manufacturing engineering. Projects can range from the design of equipment for automated production systems to the analysis and modeling of the kinematics, dynamics, and vibrations of existing systems. Students who do these projects will have the opportunity to solve real engineering problems, interact with professional engineers at one of the most automated assembly facilities in the world, and demonstrate their presentation skills. Those interested in exploring project opportunities at Gillette should contact Professor Robert L. Norton, Mechanical Engineering Department.

UMASS MEMORIAL HEALTH CARE/UNIVERSITY OF MASSACHUSETTS MEDICAL SCHOOL/TUFTS UNIVERSITY SCHOOL OF VETERINARY MEDICINE PROJECT CENTERS

Biomedical projects (MQP, IQP, PQP, and thesis) are available at UMass Memorial Health Care, University of Massachusetts Medical School (UMMS), and Tufts University School of Veterinary Medicine (TUSVM) for students from all disciplines on campus. Each of these centers is located close to WPI.

It is recommended that students spread their projects over the entire academic year. However, in some cases, full-time activity for a term can be accommodated. Students interested in project opportunities should contact the Biomedical Engineering Department Projects Faculty Coordinator well in advance of their planned project activity.
THE MAJOR QUALIFYING PROJECT

The qualifying project in the major field of study should demonstrate application of the skills, methods, and knowledge of the discipline to the solution of a problem that would be representative of the type to be encountered in one’s career. The project’s content area should be carefully selected to complement the student’s total educational program. In defining the project area within which a specific topic is to be selected, the student and academic advisor should pay particular attention to the interrelationships that will exist between the bodies of knowledge represented by courses, independent studies, and Preliminary Qualifying Projects; and by the Interactive Qualifying Projects.

MQP activities encompass research, development, and application, involve analysis or synthesis, are experimental or theoretical, emphasize a particular subarea of the major, or combine aspects of several subareas. In many cases, especially in engineering, MQP’s involve capstone design activity. Long before final selection of a project topic, serious thought should be given as to which of these types of activities are to be included. Beyond these considerations, the MQP can also be viewed as an opportunity to publish, to gain experience in the business or public sectors, or to utilize special facilities like those listed on pages 8 through 16.

Off-campus MQPs are also very valuable for access to state-of-the-art resources and contacts for future professional work.

GETTING STARTED ON AN MQP

Project topics are originated by students, faculty, or practicing professionals participating in WPI’s off-campus project programs. A faculty member in each academic department acts as Project Coordinator for all majors within the department. The Project Coordinator has assembled MQP topic descriptions being proposed and has identified the faculty who will serve as project advisors for each topic. All project opportunities—MQP, IQP, PQP, on-campus originated and off-campus originated—are made available to the student body through a planned information-sharing program of activities during C and D terms of the academic year prior to the start of the project.

PROJECT PROPOSALS

Students are strongly encouraged to begin their MQPs with a project proposal. A detailed guide to preparing project proposals is available in department offices or on the Projects Program web page (www.wpi.edu/Academics/Projects/).

THE INTERACTIVE QUALIFYING PROJECT

The Interactive Qualifying Project (IQP) challenges students to address a problem that lies at the intersection of science or technology and societal structures or human needs. The objective of the IQP is to enable WPI graduates to understand, as citizens and as professionals, how their careers will affect the larger society of which they are part. Generally, these projects involve some analysis of how technology affects, and is affected by, individuals and communities. Many of the projects are proposed by external agencies or organizations, and most are done in teams.

The IQP is an intentionally broad and integrative educational experience; student teams are drawn from all disciplines, and the topic is not necessarily related to the students’ major field. The procedure employed to relate the scientific or technological component to a social issue sometimes arises from students’ training in the social sciences or humanities. The IQP provides opportunities for significant international and pre-professional experience that are unique in technological education. (See Residential Project Centers, page 46)

PREPARING FOR THE IQP

While the preparation of most students for the Major Qualifying Project (MQP) involves extensive studies in technology, preparing for the IQP emphasizes the development of an understanding of the concepts and analytical techniques of the social sciences. The social science courses taken to satisfy the 2/3-unit social science requirement should be chosen to support IQP preparation (as explained on pages 176-179). In some cases, this background will include the study of other disciplines relevant to particular IQP topics. Preparation guidelines are included in the respective IQP division descriptions which follow, pages 39-45.

Students should begin preparing for their IQPs during their first two years at WPI; most of this preparation should be completed prior to work on the project itself. Be sure to discuss IQP opportunities with your first-year advisor. In preparing for specific IQPs, you can seek the assistance of the IQP division coordinators indicated on the following pages by the divisions below.

RESOURCES

To help students decide on an area of study and to identify faculty members who might be potential advisors, the division descriptions that follow indicate the chief areas of IQP interest. The names of faculty who have expressed interest in advising projects in each of these divisions may be determined by scanning the project proposals listed on the web-site, www.wpi.edu/Academics/Projects/. A list of residential project centers, with associated faculty, follows the division descriptions. These consultants can provide you with more information about the areas, and can assist you in finding an advisor. If you have questions or need assistance with your early exploration of interactive project opportunities, see the staff at the Interdisciplinary and Global Studies Division Office in the Project Center. Also, consulting the database of Completed Projects (on the campus computer system) is most helpful in suggesting topics and/or advisors.
PROJECT PROPOSALS
Students are strongly encouraged to begin their IQP activity with a project proposal. A detailed outline on preparing project proposals is available in the Interdisciplinary and Global Studies Division Office in the Project Center. Only students submitting project proposals and the accompanying budget are eligible for college financial support for their IQPs.

DIVISION 41, TECHNOLOGY AND ENVIRONMENT
IQPs in the environmental area have dealt with a wide range of subjects, including hazardous waste, open space planning, climate changes, acid rain, aquatic weed control, and environmental impact statements. Topics may be global or a local issue; some projects are experimental and generate new data, while others are more theoretical in nature and apply prior research data. Projects must define an appropriate interaction, and be defined and managed within the allotted time period. Environmental projects require a broad base of interest and knowledge, and therefore should be undertaken by student teams rather than isolated individuals. A faculty advisor familiar with your topic and knowledgeable in its interdisciplinary aspects will be able to help your project group.

A project proposal should be done before the actual project is initiated. This proposal should state the question being examined, review the literature in the area of concern, summarize the methodology to be used in the project, suggest the data which will have to be collected, and describe the intended usefulness of the project. This proposal may be done as the first stage of the project, or as a PQP, depending on the advisor’s requirements.

A wide range of environmental problems are available for projects. The solution to some of these problems may be sought by various environmental organizations (such as Massachusetts Audubon Society) or governments (municipalities or state agencies); the chance to work on such problems provides the student group with the opportunity to solve a real problem while providing the organization or community with a beneficial report.

PREPARATION GUIDELINES
The following courses may provide some basic skills for projects:
- BB 2040 Principles of Ecology
- CE 3059 Environmental Engineering
- SS 2117 Environmental Economics
- SS 2311 Legal Regulation of the Environment

Other courses should be taken, depending upon the particular project selected; for this reason it is helpful to think about the project in your sophomore year.

DIVISION 42, ENERGY AND RESOURCES
This division focuses on the problem of meeting society’s needs for energy and other mineral resources. The division seeks to promote interdisciplinary project work on energy and resource use and supply. We are concerned with the technological alternatives, the economic, environmental, and human value questions that must be faced in choosing among these alternatives, and the role of our social systems and institutions in determining the choices that are made.

Emergence of energy as a distinct area of project activity began at WPI with the energy crisis of 1973-1974. Since then, the pattern of interests in this area both here and elsewhere have evolved in response to international energy developments. Initially, issues of scarcity — the adequacy of the world’s energy resources to meet a growing demand and the sudden massive escalation of energy prices that occurred from 1974-1979 — were a primary concern. This period witnessed much activity in modeling energy markets and forecasting trends in energy demand, supply, and prices. Similar concerns were raised about the supply of basic metals and minerals. Many studies were undertaken of the markets for these natural resources to identify long-run price trends, the prospects for cartelization, and the need for stockpiles.

More recently, at WPI, the interests of students and faculty alike have shifted to an emphasis on “solutions.” In the last half dozen or so years, most of our interdisciplinary student projects have examined the economic feasibility, the environmental side effects, and the impact on public health and mortality of various resource technologies. Renewable sources of energy such as solar, wind, wood, and hydroelectric have been investigated frequently. More conventional alternatives to high-priced oil such as coal, natural gas, and nuclear power have received their share of attention. Many of these investigations have been of the case study type, examining the feasibility of a new technology in a particular setting. Energy independence at the level of the individual home owner has been a popular theme. But other projects have examined more global issues such as the public’s attitude toward nuclear power and its role in shaping national energy policy.

PREPARATION GUIDELINES
The implementation of government resource policies frequently involves manipulation of resource markets. The decisions our society makes about alternative sources of natural resources and the extent of resource conservation adopted will, to a large extent, be determined by the economic laws of supply and demand operating in these markets. Therefore, an understanding of how the economy functions at the level of individual economic decision makers and individual markets is essential for the effective conduct of many resource IQPs. Appraising the economic viability of alternative means of obtaining resources frequently involves making investment studies; i.e., capital budgeting.
The role of government and public opinion in the formation of our national energy policy can best be understood and analyzed by a student who has a background in sociology or political science.

To obtain information on these subjects a student would take as many of the following courses as possible:

**Management**
- FIN 2200 Financial Management
- OIE 2850 Engineering Economics
- OIE 3400 Production System Design

**Philosophy and Religion**
- PY 2712 Social and Political Philosophy
- PY 2714 Ethics and the Professions: Personal, Professional and Social Dilemmas

**Social Sciences**
- SS 1110 Introductory Microeconomics
- SS 1120 Introductory Macroeconomics
- SS 1203 Social Problems and Policy Issues
- SS 1301 U. S. Government
- SS 1303 American Public Policy
- SS 2304 Governmental Decision Making and Administrative Law

The SS courses listed above may be counted toward the 2/3-unit social science requirement.

### DIVISION 43, HEALTH CARE AND TECHNOLOGY

For much of the period since the advent of Medicare and Medicaid legislation in the mid-1960s, the cost of medical care has grown explosively. Both in inflation adjusted dollars and as a percentage of Gross Domestic Product, medical care in the United States is now at a level greatly exceeding that of the early 1960s. Furthermore, because of the aging of the American population (the over-85 age group — the so-called “frail elderly” — is the fastest growing element of our population) and the growth of expensive medical technology, forces remain strong toward an even higher level of medical expenditures.

Projects in this division address the interaction between health care technologies and the delivery of medical care in the United States. These IQP’s focus on major social concerns in medicine (e.g., Magnetic Resonance Imaging — MRI, the potential for computer-based “expert systems” in medical care, new technologies for maintaining the independence of the elderly, managerial systems to control the cost of medical care, laser surgery, etc.) and medical-moral issues (e.g., the living will, the right-to-die controversy, organ transplantation, wrongful-death and wrongful-life issues, human cloning, use of steroids in sports, universal health insurance, abortion, fetal tissue transplants, etc.).

There are several off-campus institutions and project centers available as resources for students interested in projects in this area. They include: St. Vincent Hospital, the University of Massachusetts Medical Center, the Massachusetts Biotechnology Park (located in Worcester), San Francisco General Hospital, and St. Mary’s Hospital, San Francisco. The division coordinators should be contacted for the names of WPI faculty members associated with these institutions.

### PREPARATION GUIDELINES

Projects in this division are multidisciplinary and should appeal to students with widely differing backgrounds and interests. Those students planning to do IQPs in this area should develop institutional and methodical background in both the technological and social science areas appropriate to their projects. Examples of courses which introduce social science concepts fundamental to this project area are listed below; course work in more specific topics within this project area (e.g., PY 2713, Bioethics, etc.) is also available.

**Social Sciences**
- SS 1110 Introductory Microeconomics
- SS 1120 Introductory Macroeconomics
- SS 1203 Social Problems and Policy Issues
- SS 1301 U. S. Government
- SS 1310 Law, Courts and Politics
- SS 1402 Introduction to Social Psychology
- SS 2302 Science-Technology Policy

The SS courses listed above may also be counted toward the 2/3-unit social science requirement.

### DIVISION 44, URBAN AND ENVIRONMENTAL PLANNING

Urban and Environmental Planning IQPs offer the student a wide range of opportunities to investigate and analyze problems that require a systematic and comprehensive approach. IQP topics cover a wide range of areas, including:

**Environmental analysis**—such as the investigation of the “quality of life” or the impact resulting from physical alterations of the environment.

**Environmental impact statements.**

**Resource management programs**—such as water management programs for lakes, groundwater, rivers; or forest management programs for fuel, lumber, and recreation.

**Redevelopment and renewal of city neighborhoods.**

**Rehabilitation of historic places and buildings.**

**Fiscal analysis and program impacts**—such as those resulting from the implementation in Massachusetts of Proposition 2 1/2.

**Preservation of agricultural lands.**

**Conservation and open-space planning.**

**Demographic policies and community facilities planning.**

**Land use planning.**

**Impacts of infrastructure development.**

Often these problems are complex, requiring the use of concepts and skills provided by a range of professions and disciplines: sociology, economics, political science, physical science, law, and engineering. Ignoring these
public and organizational policy by explaining how uni-
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views, and examination of legal case materials. Fre-
role in solving or preventing a problem related to science
are evident in the “treated” water from our urban areas, in the disposal of solid waste from our consumer society, in the sterility of our “planned” subdivisions, and in the global alteration of fragile environment. Comprehensive planning for our urban and natural environment necessitates a holistic approach to solving specific problems which are faced by our neighborhoods, rural environments, urban areas, and the nation, as well as the world itself. Such problems will become worse unless comprehensive planning is understood and used.

PREPARATION GUIDELINES

The concepts and skills necessary for a planning-project will depend on the specific area. Often these multidisciplinary skills are brought to a project through a team effort, in which individuals share their learned disciplinary skills and concepts to solve the problem together. The following are suggested courses which could be beneficial to students who are interested in doing projects in Area 44:

**Civil Engineering**
- CE 3070 Urban and Environmental Planning
- CE 3074 Environmental Analysis
- CE 4071 Land Use Development and Controls

**Social Science**
- SS 1203 Social Problems and Policy Issues
- SS 2117 Environmental Economics
- SS 2311 Legal Regulation of the Environment

The SS courses listed above may be counted toward the 2/3-unit social science requirement.

DIVISION 45, SCIENCE AND TECHNOLOGY: POLICY AND MANAGEMENT

Projects in this division share a concern for government’s role in solving or preventing a problem related to science and technology. Society must make collective choices about technology; increasingly, it does so through the political process. The politics of nuclear power, impact of urban forests on the environment, consumer needs and the impact upon public policy, the relationship between the educational needs of society and responses in the field of education, health policy, and organizational approaches to information management, examples of the issues addressed by students and their advisors. Frequently, the projects use one of the many techniques of policy analysis, which include statistical measures, interviews, and examination of legal case materials.

Policy analysis is one approach, but other projects have used a slightly different approach by focusing on the organizations that perform research and develop technologies. These projects contribute to the design of successful public and organizational policy by explaining how uni-
versities and corporations operate, and by identifying those organizational characteristics that are pertinent to corporate or to public policy. IQPs have analyzed the prospects for university-industry relations, the development of entrepreneurs, the implications of the diffusion of innovations in organizations, the impact of new technologies on jobs, and the government’s role in moderating the social impact of the shift to a high-technology service economy.

**PREPARATION GUIDELINES**

Students should prepare for these projects by learning about the American political economy, public policy, the legal system, and in some cases the management of organizations.

**Political Economy and Public Policy**
- SS 1203 Social Problems and Policy Issues
- SS 1301 U.S. Government
- SS 2302 Science-Technology Policy

**Legal System**
- SS 1310 Law, Courts, and Politics
- SS 2311 Legal Regulation of the Environment

**Management of Organization**
- SS 2121 Government Budgets and Fiscal Policy

Students are encouraged to blend their technical knowledge with a policy analysis. They could identify a policy issue in their major field and look at it from an economic, political, legal, or management perspective.

DIVISION 46, SOCIAL STUDIES OF SCIENCE AND TECHNOLOGY

Projects in this area cover a variety of specific topics, but are united by a general perspective which is characteristic of the field of Science, Technology and Society studies. S.T.S., as it is called, is known by its emphasis on the critical examination of conventional wisdom about the social implications of science and technology.

When proponents proclaim the dawn of a new era or predict that great social progress will accompany the emergence of a technology, S.T.S. people look for the other side of the coin. When opponents attack technology, due to the alienation, loss of meaning, and control issues it creates, S.T.S. proponents probe to see what new possibilities will emerge. Whether the result will be new freedom or new tyranny often depends on the surrounding social arrangements.

In short, the aim of a S.T.S. project is to put aside traditional thinking about the nature of technology, and really examining the ways in which technologies interact with social systems. One starts by dropping the idea that technology impacts society, rather than vice versa, and by questioning the assumption that technological advances automatically represent social progress. Much follows from this modest beginning.

S.T.S. is sometimes called “the Science of Science,” as you adopt an attitude of scientific skepticism and then look at science itself, or a technological issue. The result is
a critical, but not negative, perspective on technology which paves the way toward a balanced assessment of the benefits and costs of technical change.

Classic S.T.S. projects might involve analysis of tension between technical experts and democratically-elected leaders, the conditions under which technology seems to become an irresistible social force or the way in which distribution of wealth, power, and status are affected by technological change. Organizational “mindsets” leading to technical accidents have also been good project themes.

Technology is rarely neutral in socio-political terms, but its impact can be subtle. The most challenging and rewarding type of S.T.S. study deals with the way in which technology affects the way in which we relate to the world or view ourselves. Those interested in the interface of technology and society are often like a fish trying to understand water, the medium in which it lives. The great challenge of this field, but also its greatest reward, is that it seems to require considerable reflection about society and the role of the technologist in it to do a first rate S.T.S. project.

CURRENT PROJECT THEMES
Within this broad field, four general project themes are being developed into continuing project streams. A few illustrations of each type are offered below from the list of completed projects.
1. Technological Literacy and Public Understanding of Science
2. Reception of Scientific and Technical Innovations by Affected Communities and Technical Professions
3. Impact and Equity Issues Related to Gender, Race, Ethnicity or Social Class.
4. Reforms in Science or Engineering Education
5. Processes of Technology Transfer and Product Innovation

PREPARATION GUIDELINES
As one can see, S.T.S. is by its nature an interdisciplinary field. Hence, project preparation could appropriately draw from a range of academic disciplines. However, it is usually best to concentrate on picking up the perspective first, and a variety of courses in social sciences, history, and philosophy are taught from S.T.S. perspective. The courses that do the best job of introducing this approach include:

- SS 2208 The Society-Technology Debate
- HI 3331 Topics in Science, Technology and Society
- ID/AR 3150 Light, Vision, and Understanding
- SS 2302 Science-Technology Policy
- SS 2304 Governmental Decision Making and Administrative Law
- CS 3043 Social Implications of Information Processing
- HI 2334 European Technology Development
- EN 2252 Science and Scientists in Modern Literature

DIVISION 47, SAFETY ANALYSIS AND LIABILITY

Projects in this division deal with issues of people and property safety and the management of risk associated with the hazards inherent in today’s society.

- The analysis of risk required two components:
  1. a measure of severity, and
  2. a probability distribution

- Typical measures of severity include deaths, injuries, dollars of property damage and days of business interruption. The probability distribution gives a probability for each value the severity measure can take. Some of the risks that have been studied as part of this project division have included risks due to unwanted fires, the misuse and abuse of consumer products, those risks associated with workplace safety and risks associated with natural disasters. Risk management and analysis tools used have included scenario development, fault tree construction and event tree analysis.

- The risk associated with unwanted fires is of special interest because each year fires claim a greater toll than earthquakes, floods, tornadoes, and all other natural disasters combined. In just a few minutes time, a single fire or explosion can have catastrophic consequences in facilities ranging from hotels, hospitals and schools to high-rise offices and complex manufacturing operations. Projects in this topic have examined fire department operation, investigated the economic consequences of design changes in residential smoke detectors and evaluated firesafety risks in passive solar heated homes.

- Liability issues focus on the risk associated with products and the consequences of people’s actions. Some recent projects in this have been:
  1. Forensic Investigation of an LP-Gas Cylinder Explosion
  2. An Injury Investigation of Quadriplegia Resulting from an Automatic Shoulder Seatbelt: Design Failure or Negligent in Use
  3. Rollover Propensity of the Suzuki Samurai
  4. Legal, product liability and personal injury issues resulting from the case of Locke vs. Mack Trucking, Inc.

- Some useful courses for preparing for “Safety Analysis and Liability” IQP’s include:
  - FP 3070 Fundamental of Firesafety Analysis
  - BUS 2950 Business Law and Ethics
  - MA 4213 Risk Theory
  - SS 1203 Social Problems and Policy Issues
  - SS 1301 U. S. Government
  - SS 1310 Law, Courts, and Politics
  - SS 2311 Legal Regulation of the Environment
DIVISION 48, HUMANISTIC STUDIES OF TECHNOLOGY

The overall theme of projects in this group is the interaction of science and technology with the humanistic and nonquantitative aspects of culture. Together with the relevant fields in science and technology, the appropriate areas of culture from which the methodologies and substance of the projects will be drawn include philosophy, literature, history, religion, humanistic psychology, and the fine arts, with emphasis on values and ideas. The interaction of all levels of technology with the cultures of traditional and developing societies, as well as developed ones, is within the scope of the group. Thus, projects can range over an enormously broad area to include such diverse topics as the relationship of the literature to technology or science, philosophical analysis of the nature and role of the individual in a high-level technological society, or an historical examination of the reductionist view of man as a machine.

Whenever possible, two faculty members will advise each project, one advisor being drawn from the appropriate humanities or art discipline. Faculty members will explain to students the scientific, technological, and humanistic background necessary to begin the projects for which they will act as advisors.

PREPARATION GUIDELINES

Besides a general familiarity with the basic concepts and ideas in the physical sciences, projects in this area involve historical, cultural, social, psychological, or philosophical analysis. Many projects are aided by a general background and familiarity with the literature and fine arts of the modern era.

EN 2252  Science and Scientists in Modern Literature
HI 2332  American Science and Technology from 1859
HI 2333  History of Science From 1700
HI 2334  European Technological Development
HI 3331  Topics in Science, Technology and Society
ID/AR 3150  Light, Vision, and Understanding
PY 2711  Philosophical Theories of Knowledge and Reality
PY 2713  Bioethics
SS 2208  The Society - Technology Debate
SS 3278  Technology Assessment and Impact Analysis Seminar

Courses might also be selected from the literature, music, art, and philosophy offerings appropriate for the period and national group being studied (either American, European, or Asian), or the history of architecture.

The SS courses listed above may be counted toward the 2/3-unit social science requirement.

DIVISION 49, ECONOMIC GROWTH, STABILITY AND DEVELOPMENT

There are two major areas of interest in the division:

A.

PROBLEMS OF STABILITY AND CHANGE IN MATURE COUNTRIES

This project area is concerned with many of the issues that confront the world’s developed economies. These issues include the distribution of income and wealth, the kinds and quantities of available jobs, who obtains or fails to obtain the more desirable jobs, and the causes and consequences of inflation and recession. The analysis can focus upon particular sectors or upon the nation as an aggregate. Emphasis is placed upon the manner in which technological and social changes are integrated into the organization of work in society. Economic, social, psychological, as well as political and technological questions can be raised in this project area.

B.

PROBLEMS ASSOCIATED WITH GROWTH IN DEVELOPING NATIONS

This project area is intended to encompass a wide range of problems facing developing nations. Generally, projects analyze the environmental, social, economical, and distributional impacts of growth and development, and the design of policies aimed at eradicating poverty and unemployment. In more specific terms, these projects address such issues as sustainable development strategies, the choice of sectoral policies, the choice of monetary and fiscal policies, rapid population growth, housing and urbanization, education and training, questions of “appropriate technology” and its transfer, import substitution and export promotion, foreign aid and foreign debt, foreign investment, and the role of international firms.

PREPARATION GUIDELINES

The foci of these project areas are economics, psychology and policy studies. Students anticipating work in these areas should have a background in economics, social science, and psychology, and a familiarity with the techniques of statistical analysis and/or computer simulation. Among the courses suggested for preparation are:

SS 1120  Introductory Macroeconomics
SS 2120  Intermediate Macroeconomics
SS 2125  Development Economics
SS 1110  Introductory Microeconomics
SS 2110  Intermediate Microeconomics
SS 2117  Environmental Economics
DIVISION 50, SOCIAL AND HUMAN SERVICES

The delivery of social services is one of the most difficult and controversial problems currently faced by our society. In the past, IQPs have examined such issues as services for the mentally or physically handicapped, especially public school students, rehabilitation of juveniles, treatment for alcoholism and drug abuse, consumer information awareness, assessment of college life and student attitudes, and other community service concerns. Many projects in this division will be concerned with the strengths and deficiencies of the systems which the private and the public sectors of our society have established or are proposing to establish for dealing with community problems.

PREPARATION GUIDELINES

Projects in this category are multidisciplinary, and should appeal to students with widely differing backgrounds and interests. Those students who expect to do IQPs in this area should develop analytic backgrounds in the particular social science area(s) appropriate to their project. Examples of courses which introduce concepts fundamental to this division are listed below. Students anticipating IQPs which involve economic analysis should consider course work in that discipline. Also, projects involving surveying of public attitudes will require background in social analysis as found in SS 1402 and SS 2403. SS 2203 is an excellent introduction to problem-solving in the social sciences. MG 2300 is recommended for projects involving conflict resolution and management of social problems through industrial engineering techniques.

Recommended Courses

- OBC 2300 Organizational Science—Foundation
- SS 1110 Introductory Microeconomics
- SS 1120 Introductory Macroeconomics
- SS 1203 Social Problems and Policy Issues
- SS 2311 Legal Regulation of the Environment

The SS courses listed above may be counted towards the 2/3-unit social science requirement.

DIVISION 51, EDUCATION IN A TECHNOLOGICAL SOCIETY

Offerings in this area include projects in which WPI students teach and/or develop curricula at all grade levels from K through college in a variety of subjects. In other projects, students apply technology to learning (through research and development of teaching aids and machines), deal with mass media (methods and implications of teaching large segments of the population), or focus on the teaching-learning process (through study and research of learning models and theories).

Many projects are carried out with local regional public and private schools through the “WPI School-College Collaboration in Mathematics and Science Education.” WPI has a close working relationship with the nearby Doherty High School. For details of these programs, contact Assistant Provost Lance Schachterle, Boynton Hall.

PREPARATION GUIDELINES

Education plays a dominant role in the modern, technical society. It is a compulsory, long-term experience for a significant segment of the American population. To prepare for projects in this area, the student should have a perspective on modern American history with emphasis on the development and growth of the present educational system, an understanding of psychological development and theories of learning, and a background in the elementary concepts of social science research.

Recommended Courses

- SS 1402 Introduction to Social Psychology
- SS 1203 Social Problems and Policy Issues
- SS 2401 The Social Psychology of Education

The SS courses listed above may be counted towards the 2/3-unit social science requirement.

For students planning to develop science curriculum, the appropriate science and mathematics background is assumed.

TEACHER LICENSING OPTION

Students doing education IQPs may be interested in also qualifying as a secondary school mathematics or science teacher. For information on this option, see “Teacher Licensing” on page 133.
DIVISION 52, LAW AND TECHNOLOGY

Technological developments take place in the context of a complex legal and regulatory environment. For example, courts will apply principles drawn from unwritten common law to restrict land uses by property owners. In contrast, developments in communications, energy, and pharmaceuticals are governed by an interlocking structure of statutes and regulations at both the state and federal levels.

IQPs in this division focus on the interaction between legal and regulatory institutions and technology. Project students study statutes and their history, regulatory systems, agency decision making, and judicial decisions to determine their impact on technology.

In addition, students study the operation of technology in a legal environment to determine whether social goals expressed in law are realized in practice. Will the Clean Air Act clean air? Do regulations for the handling and disposal of toxic materials protect the public? Can regulation effectively promote energy conservation? Do procedures governing drug approval unnecessarily prevent the speedy introduction of new treatment methods?

Aspects of legal and regulatory decision making are also studied. When do courts accept scientific evidence as determinative of facts? Can scientists provide objective, expert advice for governmental decisions or are scientists destined to become partisan policy advocates?

The answers to all these questions are important if technology is to aid us in the achievement of social goals and if courts and regulatory agencies are to succeed in defining and implementing social policy.

PREPARATION GUIDELINES

Successful completion of IQPs on the topics described above depend, in part, on prior preparation in government, law and society-technology issues. The following courses support IQP research in this division:

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<th>Course Code</th>
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<tbody>
<tr>
<td>HI 2317</td>
<td>Law and Society in America, 1865-1910</td>
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<td>SS 1110</td>
<td>Introductory Microeconomics</td>
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<td>SS 1120</td>
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<td>SS 2311</td>
<td>Environmental Policy and Law</td>
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<td>SS 3278</td>
<td>Technology Assessment and Impact Analysis Seminar</td>
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Students should consider combining courses listed above to form sequences in policy studies, law, or society-technology studies. Additional information on sequences appears in the description of social science courses.

DIVISION 53, HISTORIC AND ARTISTIC PRESERVATION TECHNOLOGY

Projects in this division examine the value and policy issues surrounding decisions on which historic and artistic objects such as buildings, battlefields, statues, monuments, prints, drawings, paintings, and sculptures should be preserved and how best to preserve them. They may also deal with the technical issues involved in art conservation and restoration and involve application of the technical methods available for analyzing the composition of historic objects.

PREPARATION GUIDELINES

Ideal preparation for projects in this division would include art history and material science and familiarity with data base management programs.

Recommended Courses:

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<th>Course Code</th>
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<td>AR 1111</td>
<td>Introduction to Art History</td>
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<td>AR/ID 3150</td>
<td>Light, Vision, and Understanding</td>
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<td>AR 2113</td>
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<td>HI 1331</td>
<td>Introduction to the History of Science</td>
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<td>ES 2001</td>
<td>Introduction to Materials Science</td>
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<td>ME 2820</td>
<td>Materials Processing</td>
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<td>CHE 508</td>
<td>Catalysis and Surface Science of Materials</td>
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In addition to IQP and MQP opportunities on campus, through the Global Perspective Program, WPI students have many opportunities to work for a seven-week term at one of WPI’s residential project sites. Project work conducted at these sites provides teams of students with extraordinary opportunities to learn by solving problems provided by professional or government agencies. Most of these programs offer IQPs; MQPs and one-term Sufficiencies (see pages 58-59) are available depending on faculty advisors.

Registration for IQP work in these programs begins in the fall with the Global Opportunities Fair. At the Fair, IQP and exchange program directors will be available to talk with students about these opportunities. Students should apply in the fall of the year preceding the year in which they would like to participate. Further information is available at the Interdisciplinary and Global Studies Division in the Project Center.

All students accepted to an off-campus IQP Center are required to register for the preparation course ID 2050 in the term immediately preceding their time off campus. Students must also be making satisfactory progress in their academic program.

## RESIDENTIAL PROGRAMS

All programs offer the students the opportunity to complete a project in seven weeks of full-time work. Advance preparation is required. Faculty advisors are in residence at the site.

### TERMS OFFERED

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<td>San José, Costa Rica</td>
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<td>Venice, Italy</td>
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* MQP opportunities only.
** Sufficiency opportunities only.

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### PROGRAMS IN THE UNITED STATES

#### WASHINGTON PROJECT CENTER

Director: Prof. D. DiBiasio, Goddard Hall 218A

WPI’s Washington Project Center operates in Term B each year. Students, usually juniors and seniors, work in three-member project teams with a variety of federal, private, and nonprofit groups. In the past, projects have been completed with the U.S. Coast Guard, the Office of Patents and Trademarks, the National Science Foundation, the National Academy of Engineering, the National Society of Professional Engineers, the Agency for International Development, the Consumer Product Safety Commission, the Department of Health and Human Services, among many others. Students work on their projects at the sponsoring agency for the entire seven-week term, while living in downtown Washington, D.C., within several blocks of the White House and many government agencies.

There are several qualities that every Washington Project Center applicant should have. Most importantly, students should have a curiosity about how government works and the importance of national action in the areas of the environment, education, health, and defense, for instance, and the importance of U.S. actions on global matters. Washington is one of the information capitols of the world; thus students have the opportunity to conduct interviews with policy makers of many different disciplines and to examine data not available elsewhere. International students would find this experience to be very valuable. Secondly, students should be willing to learn about tools of social science research, which may include conducting surveys by mail, by telephone interviewing, or by face-to-face interviewing.

Living in Washington provides students an endless access to the free national museums that are part of the Smithsonian complex. They include the Air and Space Museum, the Museum of American History, the Natural History Museum, the National Gallery, the museums of African and Oriental Art. In addition there are the Lincoln, Jefferson and Vietnam Memorials; the National Holocaust Museum; the National Archives; the Washington Monument; and of course, the Senate and House hearings, which are open to the public.
BOSTON PROJECT PROGRAM

Director: Prof. F. Carrera, Project Center

WPI’s Boston Project Program operates in Term D each year. WPI project teams, with a resident WPI faculty member, work on topics offered by government agencies, environmental and community organizations, medical and financial institutions, and private-sector industrial firms.

Boston is a world-class city, with a wealth of cultural, educational, recreational and touristic opportunities. It is an exciting, vital, and stimulating environment. It is, of course, not far from WPI, which minimizes the expense of getting there and back compared to a site half-a-world away.

Students will work in teams of three on projects at the sponsoring organization for the entire seven-week term. Student housing and project assignments are arranged in advance. Selection of students for this program takes place in Term B for the following academic year. All Boston students are required to register for a preparation course offered in the C term preceding the D-Term project.

WORCESTER COMMUNITY PROJECT CENTER

Director: Prof. R. Krueger, Project Center

Students work in offices in central Worcester and commute daily from their WPI base.

Projects are recruited from private and public Worcester agencies focusing on policy issues where recommendations can make significant contributions to improving the city we live in. Sponsorship includes government, public interest, charitable and educational organizations.

Recent examples of projects include: a) a study of community Internet accessibility (sponsor: Worcester Information Technology Project); b) marketing of the Worcester Convention Center and the City Hall Plaza (sponsor: Director of Marketing for the City of Worcester); c) implementing an engineering curriculum at Doherty High School (sponsor: Worcester Public Schools) and d) issues in rehabilitating old commercial properties in the Prescott St. area for new high-tech ventures.

THE WPI/GODDARD SPACE FLIGHT CENTER MQP PROGRAM

Director: Prof. Fred Looft, Atwater Kent 229

The Goddard Space Flight Center Project Program operates in Term A each year and is for students seeking to complete their Major Qualifying Project requirement. Students work in teams of three or four on projects and problems related to unmanned, earth observation space flight systems. Recent and on-going projects have included the design and development of new coatings for next generation mirrors, a prototype of a new star pointing control system and sensor, software for optimized load sharing on computers used to design spacecraft, and the automation of a very low vacuum test chamber used to test and qualify components and systems for space-flight.

The GSFC Project Program is significant in that it supports both the WPI mission to provide off-campus project experiences to our students, and supports the Goddard mission

“To promote excellence in America’s education system through enhancing and expanding scientific and technological competence.”

From the WPI perspective, specific objectives incorporated within the development of this program include a focus on a single term (A, 9 weeks) off-campus MQP opportunity, projects in several different engineering and scientific disciplines, opportunities for WPI students to work on an intensive and focused team project in a professional technical environment, and delivering a final project report that is representative of exceptional high quality work and documentation by WPI students.

Students seeking to apply to this program should be majoring in Computer Science, Chemical Engineering, Electrical Engineering, Mechanical Engineering Math, Physics or Humanities. Other majors will be included as projects are identified and worked into the scope of the program. Students typically live in the College Park, MD, area and commute to the Goddard Space Flight Center via automobile. The advantage to this living situation is that the students have access to the Washington area, as well as the Greenbelt area where the Center is located.

Students that are accepted to this program are required to complete a PQP during D term of the previous academic year. During the PQP the student teams will develop a project proposal and start learning the engineering and science background material needed to complete their project. A one-day planning trip to Goddard is also scheduled during the PQP so that the student teams can tour Goddard and visit the facilities where they will be working. Time is set aside during this visit for the student teams to interact with their mentors. Currently students interested in this program must be U.S. citizens.

Further information on this program can be found at http://www.ece.WPI.EDU/~fjlooft/gsfc or by contacting the program director, Professor Fred Looft (fjlooft@ece.wpi.edu).

SILICON VALLEY PROJECT CENTER

Co-Directors: Prof. David Finkel, Fuller Labs 231
Prof. John Orr, Atwater Kent 229

Silicon Valley, California, is the home to many of the most dynamic companies in the computer industry and in other related high-technology industries. Established companies, such as Sun, Intel, and Hewlett-Packard, mix with small start-ups to provide an exciting atmosphere of technology and entrepreneurship. The projects will expose students to both the cutting-edge technology and the dynamic entrepreneurship of Silicon Valley.
Students participating in the Silicon Valley project center will participate in a Preliminary Qualifying Project (PQP) during B-Term, 2003. During this PQP, the students will perform background research in the area of their project, learn about the company and the industry where they will be performing their project, and hold discussions with their company mentor about their project work. One of the outcomes of the PQP is a detailed proposal, describing the general era of the project, the specific problem to be addressed, and the approach the students will adopt to solving the problem.

The projects will be conducted during C-Term 2004 in Silicon Valley. The students will work full-time at their sponsor’s site for approximately 9 weeks, from early January through early March. The students will work with a mentor from the sponsoring company and with a WPI faculty advisor. The project work will include the completion of an MQP report and a presentation on the project work to the sponsoring organization.

Admission to the Silicon Valley Project Center is based on academic standing and performance, essay response, evidence of maturity and independence, availability of projects in a specific area, qualifications relevant to the project offered, and results of an interview.

Projects may be available in a number of disciplines, including:
- Biology/Biotechnology
- Chemical Engineering
- Computer Science
- Electrical and Computer Engineering

### PROGRAMS IN EUROPE

#### DENMARK PROJECT CENTER

Directors: Prof. Peder C. Pedersen, Atwater Kent 205
Tom H. Thomsen, International House

What makes Denmark an ideal place for an IQP Project Center is a combination of several factors. The Danish culture is very much open to the kind of interdisciplinary academic questioning which is the foundation of any good IQP project.

The Denmark Project Center, located in Copenhagen, operates in D term each year. In the past, projects have been completed with The National Museum, NOAH (Danish Friends of the Earth), The Engineering College of Copenhagen, The Danish Society for the Blind and the Danish Bicycle Federation. It is expected that future IQP projects in Denmark will be related to disability and environmental issues and work with museums, in addition to continuing to work for not-for-profit organizations.

A WPI faculty advisor remains in residence throughout the 8-week period. Students are required to register for 1/6 PQP in B-term and 1/3 PQP in C-term (ID 2050) prior to leaving for Denmark. PQP work consists of project preparation including writing a project proposal and a seminar in Danish history and culture. In addition, students participate in a five-day orientation program in Denmark. The program gives an introduction to Copenhagen, Danish language, and contemporary issues.

Housing in Copenhagen will, in most cases, be apartments located near the center of Copenhagen, with stores and public transportation within a few minutes walk.

#### LIMERICK, IRELAND

Directors: Prof. Richard Vaz, Atwater Kent

Limerick is Ireland’s third largest city, and a center for both tourism and business, yet it retains the charm and feel of a small community in many ways. Limerick’s center is located on the River Shannon, and features both medieval and Georgian influences; the outskirts of the city are home to a number of high-technology business parks and a major university. The areas surrounding Limerick are famous for their natural beauty and historical significance; the Republic of Ireland is small enough so that it can be explored from end to end in a series of weekend excursions. Visitors to Ireland encounter spectacular scenery including 3,500 miles of coastline, a rich cultural and literary heritage, vibrant cities and villages, and a warm and friendly populace eager to help visitors feel at home.

MQPs in the Limerick area involve working on-site at local electronics and computer firms and research laboratories. In B term of the preceding year, project opportunities are identified for particular areas within electrical and computer engineering and students are selected. The following A term, students spend 10 weeks in Limerick, living among Irish people and working full-time in collaboration with engineers at the local firms on the projects.

MQPs in Limerick involve most areas of specialization within electrical and computer engineering, including analog and mixed-signal hardware design, digital design and embedded systems, signal processing and communications, and software engineering. Special project statements are not available until the beginning of the projects, as project sponsors typically provide the opportunity for students to work on cutting-edge problems of immediate interest to the companies.

Admission to the ECE MQP Program in Limerick is based on the following criteria: academic standing and performance, evidence of maturity and independence, qualifications relevant to the anticipated projects, faculty references, and the results of an interview.
LONDON PROJECT CENTER

Directors: Prof. P. Davis, IGSD Project Center

IQPs are available at the London Project Center in terms C, D and E. (Sufficiencies are available in terms D and E; see the accompanying description of the London Sufficiency Program.) Together with a resident WPI faculty adviser, teams of WPI students find solutions to problems posed by British public and private agencies. Housing and project assignments are arranged in advance with the assistance of WPI’s London-based Center Coordinator. Many opportunities are available during the term for visits to cultural institutions in and around London. Each term in London also includes a long weekend to permit extended travel outside of London.

Sponsors of London Center IQPs include the Tower of London, the Museum of Science and Industry, the London Borough of Merton, the Victoria and Albert Museum, the Institution for Electrical Engineers, the Association of Chief Executives of National Voluntary Organizations, the Royal Hospital for Neuro-disability, the Dickens House and many other organizations.

Selection of students for the London Center for the following summer and academic year normally begins in term B. Interested students can begin the application process by attending the Global Opportunities Fair in September. All London IQP students are required to enroll in ID 2050 and to complete a PQP in the term preceding their term in London.

LONDON HUMANITIES PROGRAMS

Coordinator: Prof. P. Quinn, Salisbury Labs 17

WPI offers Sufficiency Projects in London in Terms B and E. London Sufficiency Projects are interdisciplinary and intended for students with many backgrounds in the humanities and arts. London was once the center of a global empire and its influence continues to radiate throughout the British Isles and well beyond. Sufficiency students in London study topics that might include history, literature, music, theatre, or culture, and work on projects that build on at least three previous courses in humanities and arts. As an interdisciplinary program, the London Sufficiency is not limited to the history or literature of Britain, but all projects take advantage of the unique resources available in London. These include some of the world’s most vibrant theatre and the arts, outstanding museums, ambitious architecture, the libraries of the University of London, collections of film or sound recordings, and much more. London Sufficiency Projects are appropriate for students with a background in art history/architecture, drama/theatre, history, literature, music, philosophy, religion, or writing/rhetoric. Students planning a minor or major in International Studies, Humanities and Arts, or Technical Scientific, and Professional Communication, also may study in London in conjunction with this program.

VENICE PROJECT CENTER

Director: Prof. Fabio Carrera, Project Center

Called the most beautiful city in the world, Venice has a haunting atmosphere which easily evokes the splendor of its past. A city with an outstanding historical, artistic and architectural heritage, much of its uniqueness comes from its symbiotic relationship with the sea and the lagoon. Yet today, this relationship contributes to serious environmental and economic problems. As daily life revolves around the canals, proposed solutions to these problems usually have a direct impact of the inhabitants of Venice.

The IQPs in Venice provide an opportunity for students to see the implementation of their projects put to use for the benefit of an entire city. Projects are conducted for Venetian, American and international organizations and include environmental, socioeconomic, artistic, cultural and technical concerns important to the sustainability of this historic city.

WPI faculty advisors remain in residence throughout the 8-week term. Students are required to register for three preparatory activities: a 1/6 unit on Italian history and culture in Term C; a 1/6 unit on the Italian language in Term D; and a 1/6 unit PQP in Term D. Prior knowledge of the Italian language is not required.

PROGRAMS IN ASIA

BANGKOK PROJECT CENTER

Directors: Prof. C. Demetry, Washburn Shops

To commemorate the 125th anniversary of the college with its theme of “WPI in the World,” WPI established its first Project Center for IQPs in Asia in 1989. Students conduct IQPs in Bangkok, Thailand, in Term C annually. WPI students carrying out IQPs in Bangkok have incomparable opportunities to investigate, first-hand, the rapidly growing technologies and economies of Asia. While all projects are conducted in English, students have many opportunities to encounter Thai culture. Projects are usually sponsored by local universities, government agencies, or by U.S. companies with Asian offices. Numerous projects involving the environment and service to the poor have been carried out in Bangkok since the Center’s founding.

IQP topics, housing, and travel arrangements for Bangkok are arranged in advance through resident coordinators in Bangkok, in conjunction with Chulalongkorn University.
HONG KONG, CHINA PROJECT CENTER

Coordinator: Prof. C. Peet, Project Center

The Project Program in Hong Kong provides a gateway to the most dynamic and important region on the planet. The wealth of the world has moved to Asia and Hong Kong plays a crucial role in the development of China — historically the most significant actor in Asia. This city radiates energy as it rapidly modernizes and takes the lead in economic development, high-rise building, historic preservation and artistic conservation.

In Hong Kong, WPI is aligned with Caritas, a Catholic Charity and educational institution with a worldwide network of sites. Caritas has advised IQPs since 1990, and, with Hong Kong’s reversion, Caritas has expanded its operations to the mainland of China. Caritas maintains resort housing available to WPI students on the outer islands of Hong Kong, and the Bianchi Lodge in Kowloon. WPI is also working with the “Civic Exchange”, a newly established think tank in Hong Kong that deals with a vast variety of issues including environmental and energy policies.

IQPs will deal with environmental, energy and social issues, web applications, educational surveys, and other topics as appropriate.

MQPs may be available in a number of disciplines, including:
- Chemical Engineering
- Electrical Engineering
- Civil Engineering
- Other fields as negotiated

PROGRAMS IN LATIN AMERICA

COSTA RICA PROJECT CENTER

Director: Prof. Susan Vernon-Gerstenfeld, IGSD, Project Center

The project center, located in San Jose, Costa Rica, operates in E-term. In this stable democracy, students have the opportunity to perform IQPs in a variety of settings ranging from rain forests, to local manufacturing plants, to multi-national companies and organizations, to non-profit organizations, and to Costa Rican government offices.

Since Costa Rica is a rapidly developing nation, the interactions between technology and social implications are graphic. Working full-time, in each sponsoring organization, students experience the thrill of a new culture and the pleasure of providing needed work for the sponsor. Teamwork is the rule for participating students, who have designed a national GIS system for the fire department, developed a method for removing latex from the processing of bananas so that there can be 100 percent recycling of water, developed an interactive rainforest exhibit in the national science museum, worked to develop an inexpensive fish farming system to supply a means of living for with subsistence farmers in any developing nation, organized a plan for ecological education through a bird watching program for a world renowned botanical garden, developed an environmental policy for a rainforest that operates tourist activities according to sustainable development principles, as well as many others.

Before leaving to go on-site, students participate in a 1/2 unit of preparation. In Costa Rica, students have the opportunity of improving their Spanish, if they have some, or learning enough for survival through a short intensive course taken during the beginning of their stay. They continue their immersion during their off-hours on all of the myriad excursions they will undertake throughout the country or by simply being in Costa Rica. However, most of the projects can take place using English. Housing and transportation are arranged before the students leave.

Costa Rica is the center of bird migration from both South and North America. It hosts live and dormant volcanoes, dense but very explorable jungles and rainforests, and has world-renowned beaches, as well as very amicable people.

PUERTO RICO PROJECT CENTER

Director: Prof. Susan Vernon-Gerstenfeld, IGSD

The Puerto Rico Project Center operates in D-term in San Juan, Puerto Rico, the capital of the Commonwealth of Puerto Rico. As in other off-campus centers, students work full-time, in the offices of the government of the Commonwealth, as well as in industry. Students perform their work under the guidance of a WPI faculty person who accompanies the students to San Juan. In addition, the sponsoring agency or company provides a liaison person to work with the students.

Projects span a wide variety of topics such as transportation, health, housing, the environment, social welfare, infrastructure, and land use for a few examples. The fact that these concerns apply to an island and a culture different from that of mainland U.S. makes them particularly interesting.

Students interested in this center will have the opportunity to learn some Spanish if they wish or to apply that which they already know. They will also have the opportunity to be immersed in a Latin culture and to having access to a large metropolitan area. There will be abundant opportunities to see other parts of the island and to visit sites such as the Arecibo (outerspace) Observatory, El Junque national rain forest, the phosphorescent bay at La Parguera, the art museum at Ponce, El Moro fortress in San Juan, the white sand beach at Loquillo, and various indigenous people. Housing and transportation are arranged before the students arrive on site.

Students participate in 1/2 unit of preparation prior to leaving campus for the on-site portion of their work.
PROGRAMS IN AUSTRALIA

AUSTRALIA PROJECT PROGRAM

Directors: Prof. J. Barnett, Higgins Laboratory 105
Prof. H. Ault, Higgins Laboratory

WPI’s Australia Project Program, based in the city of
Melbourne, operates in Term D each year. As this is a rela-
tively new project site, the project topics in Melbourne
may change significantly from year to year. Current spon-
sors include the Fire Protection Association of Australia,
the Department of Human Services, the Commonwealth
Scientific and Industrial Research Organization and Arup
Fire, a local engineering consulting firm.

Melbourne, situated along Australia’s southeast coast, is
the country’s second largest city. It is a city of parks and
gardens, specializing in arts festivals, sporting events, and
fine dining. It was voted “the world’s most livable city” in
the international survey. Melbourne is also a fine place
from which to explore the diversity of Australian life, being
a short distance from mountains, deserts, beaches, mining
towns, and extensive parklands and wildlife reserves.

It is anticipated that opportunities will exist for some
satellite projects, without a resident WPI faculty member,
in Darwin and possibly other major Australian cities.

Students will normally complete two 1/6 unit PQP ac-
tivities. These will normally be completed in terms B and C.

Students will work in teams of three or four with a resi-
dent WPI faculty member, on projects at the sponsoring
organization for the entire seven-week term. Student
housing and project assignments are arranged in advance.
Selection of students for this program takes place in Term
B for the following academic year.

REQUIREMENTS FOR INDIVIDUALLY SPONSORED
RESIDENTIAL PROJECTS (ISRPS)

Many students and faculty augment the educational op-
portunities available at WPI’s formal project centers and
programs with individually sponsored residential, off-
campus projects. All such programs must adhere to com-
mon, carefully structured risk management protocols
such as those developed and implemented at established
project centers. Otherwise, students, faculty, and WPI are
exposed to unnecessary risk.

Hence, the Provost requires completion of the following
risk management protocol by all faculty intending to ad-
vise students who will earn academic credit while in resi-
dence off-campus in individually sponsored projects.

1. Two terms in advance of the off-campus activity: Fac-
ulty advisor sends a letter of intent to the Provost’s
office. The letter describes the scope of the anticipated
project, where it will happen, how many students
will participate, and the term that the students will be
off-campus.

2. Ten weeks prior to departure: Faculty advisor sub-
mits a completed ISRP form (PDF) to the Provost’s
office. The ISRP form is co-signed by the academic
department head (MQP or Sufficiency) or Dean of
IGSD (IQP).

3. Six weeks prior to departure: Student participant(s)
submit the following forms to the faculty advisor: the
Acknowledgement of Voluntary Participation, the
Off-Campus Students’ Health Update and Records
Release Form, and the WPI Off-Campus Travel Infor-
mation Form (PDF).

4. Five weeks prior to departure: The advisor submits
these completed forms (item 3) to the IGSD.

Please note that all forms can be located on the Web at
http://www.wpi.edu/Academics/Depts/IGSD/
Project registration will not be complete until the condi-
tions of this protocol are met.

At the completion of step 2, WPI’s risk managers will
review the information provided and make a recom-
men-dation to the Dean of IGSD, who will assist the Provost in
making a final decision to approve or disapprove the ac-
tivity based on considerations of risk management. The
faculty advisor will learn of this decision no later than the
first day of the term preceding the proposed activity.

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<td>By June 20th</td>
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<td>Completed Health &amp; Safety Forms for each student submitted to the IGSD</td>
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<td>By September 25th</td>
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LIVING MUSEUMS PROGRAM

The Living Museums Program provides students with unusual opportunities to carry out IQP projects at various culturally rich museums of New England. Museums synthesize knowledge and combine artifacts with primary and secondary documents, often to create an entire social and physical environment. Thus, as students work with professional staff, documents, and artifacts at museum sites, they gain an understanding of the past and present, and begin to see how distinct aspects of human life fit together to form a specific culture. At the outstanding museums participating in the program, students can select projects from a varied list of areas ranging from medieval warfare at the Higgins Armory Museum in Worcester to the rich history and literary culture of Concord, MA, at the Concord Museum and the Thoreau Lyceum.

Special projects are available each summer in Term E at several museums and historical institutions such as: Mechanics Hall, Worcester, MA; the Worcester Historical Museum; Fruitlands Museum in Harvard, MA, Martha’s Vineyard, and Higgins Armory Museum.

GENDER, RACE, AND TECHNOLOGY

Prof. S. Vernon-Gerstenfeld, IGSD

Student projects in this program research issues in two general areas: (a) the participation of women and people of color in engineering and science education and in engineering professions, and (b) the effects of particular technologies on women, African Americans, Hispanics, Native Americans, and other specific racial or ethnic groups.

Projects are often coadvised, with one advisor from humanities or social science, and one advisor from science, engineering, or computer science disciplines.

Past and ongoing project topic areas include:

• sex differences in learning styles in technical subjects
• ethics and reproductive technologies
• science and math education for precollege Native Americans, Hispanics and African Americans.

Project ideas in these or other areas related to gender, race, and technology can be initiated by students or faculty. For more information, contact Prof. Susan Vernon-Gerstenfeld, Project Center 216.

AWARDS AND SCHOLARSHIPS

THE PRESIDENT’S IQP AWARDS

The President’s IQP Awards have been established to encourage and recognize meritorious accomplishment in the performance of the Interactive Qualifying Project. To be considered for an award, the IQP, while of overall good quality, should be outstanding in conception, execution, and presentation. There are no predetermined categories for the awards, but the award will recognize the qualities in which the project excels. By thus calling attention to projects which are deemed to be outstanding, the awards help to establish standards for exceptional quality in IQPs.

Each award consists of a certificate of merit to each student and an honorarium. The IQP awards competition is conducted each fall. For further information, see Dean Paul Davis, IGSD Office, Project Center.

THE PROVOST’S MQP AWARDS

The Provost of WPI conducts an annual competition to recognize several project teams in each discipline whose MQPs, in the view of the judges, have been unusually innovative, well executed, and well presented. To qualify as a contestant, the student team must be identified by the department of the team as one of the best presenters in the department oral competition. For more information, contact Associate Provost Lance Schachterle in Boynton Hall.
The word “Sufficiency” usually designates the WPI humanities and arts degree requirement. It indicates a thematically related course and project sequence “sufficient” to give students an idea of how knowledge is obtained and expressed in a non-technical discipline.

Rather than offer merely an impression of many different areas of the humanities and arts, the WPI Plan calls for a meaningful grasp of a single thematic topic or a single discipline. The Sufficiency is not equivalent to fulfilling a distribution requirement by passing a certain number of unrelated courses. Instead, courses are taken in a chosen area of the humanities or arts, or they are focused on a theme that combines more than one area. They culminate in a final independent study, in which the student begins to do original work in an aspect of the humanities or arts.

The culmination of each student-selected sequence will be an independent study, producing a critical or research essay or, in combination with an analysis, short stories, poems, works of music or musical performances, visual art, or dramatic performances. (See also “Foreign Language Sufficiency” exception.) The final accomplishment must sum up the previous work in the humanities and arts not only by drawing upon what has been learned in previous work, but also by exploring new territory. The goal is to give the student enough background in one area of the humanities and arts so that—just as a student with an engineering or science major gains insight into how human creativity is exercised in such fields—in fulfilling the Sufficiency, the student learns how the mind creates, appreciates and criticizes work in the humanities and arts.

GOALS OF THE SUFFICIENCY
To develop an ability to display increased knowledge and initiate critical thinking and to present arguments in a manner consistent with the type of project.

To develop an ability to communicate clearly, precisely, and accurately about the process, product, or research selected for the project.

To develop an ability to discover and employ appropriate resources or references throughout the project work.

To develop an ability to apply individual creativity and originality in an effort directed toward achieving the goals of the project.

To develop the ability to present the project work in a mode that is consistent with the professional standards for the type of project undertaken.

REQUIREMENT MET BY “OVERALL EVALUATION OF TWO UNITS OF WORK”
Students normally fulfill the humanities and arts degree requirement by completing two units of work consisting of five student-selected, thematically related courses or independent studies (each for 1/3 unit of credit) of increasing complexity. These courses culminate in the final 1/3 unit of independent study dealing with the theme running through the previous work. The theme of the Sufficiency project may derive from a single discipline or may draw upon ideas or use analytic tools from more than one humanities and arts discipline.

The faculty member advising the final independent study will certify that the student’s theme is consistent with previous work. Evaluation of this final independent study, which will be based on a research essay or on creative works or performance accompanied by analysis or participation in a seminar, will result in the final grade for the Sufficiency as a degree requirement. (See “Foreign Language Sufficiency” exception.) Students and faculty members should make clear at the outset of the final independent study what specific means of evaluation will be used for the culmination of the Sufficiency.

Advice and guidelines for the setting up of Sufficiency themes are available from department members as listed on pages 54 and 244. However, responsibility for the selection of specific courses leading to the final independent study rests ultimately with the student. Students are, therefore, urged to consult with a Humanities and Arts Department faculty member about possible final themes for the Sufficiency no later than the beginning of their third course in humanities and arts. Such early discussion of possible thematic topics enables students to plan effectively for additional work and strengthens greatly the cohesiveness of the final independent study.

A file (filed by advisor’s name) of all essays and portfolios accepted in completion of the Sufficiency in the previous academic year is available in the Humanities and Arts Department office. Students wishing to see what kinds of topics have been completed previously and how they relate to course work should examine examples of essays in areas of interest to them.

TRANSFER STUDENTS AND THE SUFFICIENCY REQUIREMENT
Transfer credit in the Humanities and Arts at WPI is granted on a course-for-course basis. All Transfer and 3-2 Program students entering WPI with fewer than six courses or their equivalent of transfer credit in the Humanities and Arts must complete thematically-related work in the Humanities and Arts, including a Sufficiency evaluation (#5 Independent Study/Project) to the extent that the overall Humanities and Arts credit totals two units.

No credit toward the Humanities and Arts requirement is given for introductory-level foreign-language courses unless the entire Sufficiency program is in that foreign language. Usually only one transfer course in Freshman English can be applied toward the Sufficiency requirement. In all cases, the Humanities and Arts Consultant who will serve as the advisor of the student’s #5 IS/P (“Sufficiency”) has the final decision on what courses are acceptable within the student’s Sufficiency sequence leading up to the project. Up to one unit (i.e. three courses) of transferred work in the Humanities and Arts that is not credited toward the Humanities and Arts Requirement can be credited toward the fifteen-unit graduation requirement; such courses shall receive credit under the category of EL 1000.

If a Transfer or 3-2 Program student has completed two units of acceptable college-level work in the Humanities and
Arts prior to entering WPI, a Completion of Degree Requirement form will be submitted by the Humanities and Arts Department Coordinator for Transfer Students at the request of the student. The grade for such a Humanities and Arts Requirement met by transfer credit is normally a B or C, but a student can request a grade of “CR”. Students whose grades on transferred courses average A can submit samples of their course work and may be awarded an A for the Humanities and Arts Sufficiency Requirement. Alternately, a transfer student may elect to undertake a #5 Sufficiency IS/P in an effort to achieve an A grade. These evaluation options must be exercised prior to the Department’s submission of the Completion of Degree Requirement form to the Registrar.

Decisions concerning credit toward the Humanities and Arts requirement are made by the Humanities and Arts Coordinator for Transfer Students, Professor James Hanlan. He can be contacted in room 26 of Salisbury Laboratories, or at extension 5438, or email jphanlan@wpi.edu.

**DEVELOPING A SUFFICIENCY PROGRAM IN HUMANITIES AND ARTS**

The Humanities and Arts department offers most of its courses at the 1000-, 2000-, and 3000-level. Students are strongly encouraged to include one 1000-level course, two 2000-level courses, and one or more 3000-level courses in their program of five humanities and arts courses prior to their Sufficiency project term. Since the 1000-level courses may prove useful in developing a sense of what constitutes a theme in an area of the humanities or arts, the Department will accept two 1000-level courses toward the final Sufficiency project, as long as one of the courses involves material thematically related to that project. This progression through an area of study offers the student an opportunity to build an intellectual understanding of a subject while acquiring a cohesive broadening of knowledge that will lead to a challenging and rewarding Sufficiency program.

**1000-Level Courses**

Courses on this level introduce a discipline through exploration of available resources and research techniques, identification of critical issues, and examination of major themes, ideas, and interpretations.

**2000-Level Courses**

Courses on this level enhance both the knowledge and understanding of an area of study through concentration on specific themes, ideas, or approaches and refinement of expressive and analytic skills.

**3000-Level Courses**

Courses on this level, offered in a seminar format, focus on the application of those critical and analytical skills developed in lower-level courses, leading students to well defined Sufficiency project topics.

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**AREAS FOR THE SUFFICIENCY IN HUMANITIES AND ARTS**

In developing the Sufficiency requirement (see the “Humanities and Arts Sufficiency” section, page 21), students will choose courses from traditional academic disciplines within the broad area of the humanities and arts at WPI. The Sufficiency program may be limited to courses in a single discipline, such as European history or English literature, or it may include more than one discipline and involve courses, for example, in the history, literature and philosophy of a particular period. In both cases, it is essential that a single “theme,” derived from the various courses, be developed in the final Independent Study/Project (IS/P). Students are urged, before or during their third course in the sequence, to consult with a Humanities and Arts faculty member regarding their intended final IS/P.

**Humanities and Arts Areas and Consultants**

<table>
<thead>
<tr>
<th>Topics</th>
<th>Project Advisor</th>
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<tbody>
<tr>
<td>Topics in American Studies</td>
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<tr>
<td>Project Advisor</td>
<td></td>
</tr>
<tr>
<td>Topics in American Studies</td>
<td>S. Bullock (SCB), J. Hanlan (JPH), K. Ljungquist (KPL), J. Manfra (JM), L. Menides (LJM), W. Mott (WTM), J. Trimbur (JOT), M. D. Samson (MDS), D. O’Donnell (DMO), S. Vick (SV), D. Dollenmayer (DZD), A. Rivera (AAR), H. J. Manzari (HJM), A. Rivera (AAR)</td>
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<tr>
<td>Topics in Art</td>
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<tr>
<td>Topics in Drama/Theatre</td>
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<tr>
<td>Topics in Foreign Language (German)</td>
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<tr>
<td>Topics in Foreign Language (Other)</td>
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<tr>
<td>Topics in Foreign Language (Spanish)</td>
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<tr>
<td>Topics in Global Studies</td>
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<tr>
<td>Topics in History (American)</td>
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<tr>
<td>Topics in History (Interrelated)</td>
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<tr>
<td>Topics in History (European)</td>
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<tr>
<td>Topics in History (Science and Technology)</td>
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<tr>
<td>Topics in International Studies – Humanities (Interrelated)</td>
<td>P. Hansen (PHH), J. Zeugner (JFZ)</td>
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<tr>
<td>Topics in Literature (American)</td>
<td></td>
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<tr>
<td>Topics in Literature (Contemporary)</td>
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<td>Topics in Literature (English)</td>
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<td>Topics in Music</td>
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<td>Topics in Philosophy</td>
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<td>Topics in Religion</td>
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<tr>
<td>Topics in Writing, Rhetoric, and Communications</td>
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<tr>
<td>J. Trimbur (JOT), L. Higgins (LDH)</td>
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**Declarations of Student Academic Philosophy**

Students whose grades on transferred courses average A can request a grade of “A” for the Humanities and Arts Sufficiency Requirement form to the Registrar.
A descriptive listing of the humanities/arts disciplines follows.

AM—AMERICAN STUDIES
Students considering Sufficiencies in American Studies may begin with HU 1411, Introduction to American Studies, or may include that course early in their sequence. American Studies is an interdisciplinary Sufficiency program. Students should select courses from the areas of literature (EN), history (HI), philosophy (PY), religion (RE), art history and architecture (AR), and music (MU) and should, in the final Sufficiency project, investigate an American theme which derives from the courses selected.

AR—ART HISTORY/ARCHITECTURE
Students considering Sufficiencies in the history of art or architecture should begin with AR 1111, Introduction to Art History, or the 2000-level course offerings in modern art or architecture. Another WPI course relevant to an art Sufficiency is AR/ID 3150, Light, Vision, and understanding, which relates painting to the history and philosophy of science. A variety of independent studies are also available. Students are encouraged to consider studio art courses and some of the more specific upper-level courses in the arts offered elsewhere in the Worcester Consortium, especially at Clark University and the College of the Holy Cross (catalogs available at Gordon Library).

EN—LITERATURE (INCLUDING DRAMA/THEATRE)
Students selecting Sufficiencies in literature may begin by selecting any of the 1000- or 2000-level EN courses. Subsequent courses may emphasize American or British literature, drama/theatre, fiction or poetry, or any mixture of these; or subsequent courses may seek to define themes involving any other humanities and arts disciplines. However, in every case students should consider with care how the first five courses are preparing them to define and develop a theme in their final Sufficiency independent study.

FOREIGN LANGUAGES
For a description of Sufficiencies in German, Spanish, and in other foreign languages, see page 57.

GS—GLOBAL STUDIES
Students considering Sufficiencies in Global Studies may begin with HI 1341 Introduction to Global History, or may include that course early in their sequence. Global Studies is an interdisciplinary Sufficiency program. Students should select courses from the areas of: literature (EN); foreign language, civilization and literature (SP, GN); history (HI); philosophy (PY); religion (RE); art history and architecture (AR); and music (MU). In the final Sufficiency project, they should investigate an issue from a global perspective that derives from the courses selected.

HI—HISTORY (INCLUDING HISTORY OF SCIENCE AND TECHNOLOGY)
Students selecting Sufficiencies in history may begin by taking any of the 1000- or 2000-level HI courses. Subsequent courses may emphasize history in the following categories: general, cultural, diplomatic, intellectual, psychological, social, science and technology, or any mixture of these. Subsequent courses may also seek to define themes involving any other humanities and arts discipline.

In any event, students should consider carefully how the five courses are preparing them to define and develop a theme in their final Sufficiency independent study.

HU—HUMANITIES
Courses in a variety of topics are listed under the general title of Humanities; many of these could be used in interdisciplinary Sufficiency themes or related to conventional disciplinary themes in several areas.

MU—MUSIC
Individual music courses are available to any interested WPI student, and private instruction is available in both voice and musical instruments. However, for those planning a Sufficiency in music (involving five courses and a final IS/P), a minimal level of music capability on the student’s part is assumed.

For Sufficiency students, MU 1611 and MU 2611, Fundamentals of Music I and II (or the equivalent knowledge) should be completed early in students’ musical course work. The Sufficiency’s purpose is to acquaint students with the basic vocabulary of music (in Fundamentals); with aspects of music history (in the 2000 courses), and with areas of special interest, which might include performance work in ensembles or in private lessons, independent study (such as composition or theory, and computer music), or selected work at other Consortium institutions.

Also available to interested students are the following ensembles sponsored by the music faculty. Those listed here currently receive credit toward the music Sufficiency.

Choral
Men’s Glee Club
Women’s Chorale
Chamber Choir

Instrumental
Brass Ensemble
Concert Band
Jazz Band
Stage Band
Pep Band (football and basketball, athletic credit)
Medwin String Ensemble
Chamber Orchestra

There is no sequential significance to courses above 2000; however, students should select five courses (or three beyond Fundamentals I and II) which give meaningful sequential significance to their particular musical interests, with the final IS/P reflecting the realization of these goals.

PY AND RE—PHILOSOPHY AND RELIGION
Students can follow a sequence of courses concentrating on either philosophy or religion, though a coherent combination of philosophy and religion courses is also possible. Students doing a Sufficiency in philosophy or religion will normally take three courses below the 3000 level before pursuing more advanced courses at the 3000 level. Since each individual 3000-level course is offered every other year, students should plan early the advanced topics they wish to pursue in order to organize their sequences around the year(s) in which are offered the 3000-level courses of particular interest to them. In planning their Sufficiency sequences, students might find it constructive to take humanities and arts courses outside philosophy or religion that relate to the theme of their Sufficiency.
GETTING STARTED IN HUMANITIES AND ARTS

These are the “1000” or “2000” level courses from which most students select their first Humanities and Arts elective.

<table>
<thead>
<tr>
<th>Art History and Architecture</th>
<th>Interdisciplinary</th>
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<tbody>
<tr>
<td>AR 1111 Introduction to Art History</td>
<td>HU 1411 Introduction to American Studies*</td>
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<tr>
<td></td>
<td>HU 1412 Introduction to Asia</td>
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</tbody>
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<table>
<thead>
<tr>
<th>English</th>
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<tbody>
<tr>
<td>EN 1221 Introduction to Drama: Theatre on the Page and on the Stage</td>
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<tr>
<td>EN 1222 Shakespeare in the Age of Elizabeth</td>
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<tr>
<td>EN 1231 American Literature: Beginnings Through Hawthorne</td>
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<tr>
<td>EN 1242 Introduction to English Poetry</td>
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<tr>
<td>EN 1251 Introduction to Literature</td>
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<tr>
<td>EN 1257 Introduction to African American Literature and Culture*</td>
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<tr>
<td>EN/WR 2211 Elements of Writing</td>
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<tr>
<th>Foreign Language</th>
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<tbody>
<tr>
<td>GN 1511, 1512 Elementary German I,II</td>
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<tr>
<td>GN 2511, 2512 Intermediate German I,II</td>
</tr>
<tr>
<td>SP 1523, 1524 Elementary Spanish I,II</td>
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<tr>
<td>SP 2521, 2522 Intermediate Spanish I,II</td>
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<tr>
<th>History</th>
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<tbody>
<tr>
<td>HI 1311 Introduction to American Urban History</td>
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<tr>
<td>HI 1312 Introduction to American Social History</td>
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<tr>
<td>HI 1313 Introduction to the Study of Foreign Policy and Diplomatic History</td>
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<tr>
<td>HI 1314 Introduction to Early American History</td>
</tr>
<tr>
<td>HI 1321 Introduction to European Social History</td>
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<tr>
<td>HI 1322 Introduction to European Cultural History</td>
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<tr>
<td>HI 1331 Introduction to the History of Science</td>
</tr>
<tr>
<td>HI 1332 Introduction to the History of Technology</td>
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<tr>
<td>HI 1341 Introduction to Global History</td>
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<tr>
<th>Interdisciplinary</th>
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<tbody>
<tr>
<td>HU 1411 Introduction to American Studies*</td>
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<td>HU 1412 Introduction to Asia</td>
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<tr>
<th>For International Students</th>
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<tbody>
<tr>
<td>IS 1811 Writing for Non-native Speakers of English</td>
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<tr>
<td>IS 1812 Speech for Non-native Speakers of English</td>
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<tr>
<td>IS 1813 American History for International Students</td>
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<tr>
<th>Music</th>
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<tbody>
<tr>
<td>MU 1611 Fundamentals of Music I</td>
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<thead>
<tr>
<th>Philosophy and Religion</th>
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<tbody>
<tr>
<td>PY/RE 1731 Introduction to Philosophy and Religion</td>
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</tbody>
</table>

*Offered in alternate years.
PERFORMANCE SUFFICIENCY IN MUSIC

The final IS/P in music is available as a performance IS/P only with the written permission of a WPI faculty member in music. Such consent must be obtained before the beginning of the term in which the student is to perform. Performance Sufficiencies will be available only to students who can demonstrate an underlying knowledge of essential music theory and music history.

In addition to their performance, all students in a performance Sufficiency must submit a substantial essay that articulates how their academic knowledge of music was enhanced by the performance. The grade for the Sufficiency will be based on the level of both the performance recital and the essay.

PERFORMANCE SUFFICIENCY IN DRAMA/THEATRE

Students may complete a performance Sufficiency project in theatre by participating in a production of a play, either as part of the regularly scheduled Humanities and Arts Department Productions, as a part of the Masque season of play production, or in some other way. In addition to the performance, each student must complete a substantial written document which reflects the performance work and demonstrates considerable knowledge of the area of expertise. Project advisors: Prof. S. Vick and Dean O'Donnell, Humanities and Arts.

The IGSD periodically cosponsors projects at the London Project Center or the Edinburgh International Festival Fringe in conjunction with the Department of Humanities and Arts. For more information on these opportunities, contact the Department of Humanities & Arts, Division of Drama/Theatre.

FOREIGN LANGUAGE SUFFICIENCY

Students who have taken some German or Spanish before coming to WPI should attend the foreign-language placement session during New Student Orientation to determine the appropriate level at which to begin the Sufficiency. Most students complete the Sufficiency in Foreign Language by passing six courses in the language. Students who can begin language study at WPI on or near the advanced level may complete the Sufficiency by writing a final IS/P in German or Spanish.

Students interested in a language other than German and Spanish can complete a Sufficiency in that language by taking courses offered by the Consortium. For further details see Prof. Rivera, Salisbury Labs 16.

FOREIGN LANGUAGE AND CIVILIZATION SUFFICIENCY

Students who wish to combine foreign language courses with other fields in the humanities and arts should note the following guidelines:

Students may supplement intermediate or advanced foreign language courses by completing their Sufficiencies in related humanities and arts fields that deal with the culture of that language and the countries where it is spoken. The final IS/P must be written in English. Note: Elementary courses in the foreign language do not count towards this Sufficiency.

For further details on foreign language courses and Sufficiencies, see Prof. Dollennmayer, Alden Memorial 209.

GUIDELINES FOR GRANTING TRANSFER CREDIT TO U.S. STUDENTS FOR FOREIGN LANGUAGE STUDY

A. Credit for study on the high school level:
   1. Transfer credit of 1/3 unit is given for Advanced Placement with a score of 4 or 5.
   2. Students with three or more years of foreign-language study in high school, but who have not taken the Advanced Placement examination in that language, may receive 1/3 unit credit for their high school language study upon satisfactory completion of two courses in the same language on the intermediate level or above. (Note: Courses in German and Spanish in addition to those offered at WPI, as well as courses in other languages, are available at other colleges in the Consortium.)
   3. In either case 1. or 2. above, in order to receive 1/3 unit credit, students must begin their WPI course sequence at the Elementary II level or above.

B. Credit for study at other colleges and universities:
   1. Language study which is done at other universities and colleges prior to entering WPI, or done with the prior written permission of the student’s Humanities and Arts Consultant (not the Department Head) as part of an agreed-upon Sufficiency sequence, transfers on a course-for-course basis.
   2. Language study which is done at foreign universities, language institutes, cultural institutes, etc., prior to entering WPI, or done with the prior written permission of the student’s Humanities and Arts Consultant (not the Department Head) as part of an agreed-upon Sufficiency sequence, is assessed by the Foreign Languages Consultant on the basis of matriculation papers and the level or work accomplished.

SUFFICIENCY PROGRAM FOR HUMANITIES AND ARTS MAJORS

Students majoring in Humanities and Arts would normally fulfill the Sufficiency requirement in an engineering or science area. One of the primary responsibilities of the Humanities and Arts student will be to devise, with an advisor’s help, a substantial program of scientific and technological studies leading to the completion of the Sufficiency requirement. Before developing their programs, students should have clearly in mind what career goals they wish to reach and should be prepared to schedule as many scientific courses as are needed to qualify them as literate in some area of technology. The minimum technological requirement for the student fulfilling the Sufficiency requirement by coursework is two units of study. Many career opportunities may demand more extensive preparation in technological disciplines, and students are
strongly advised to take full advantage of WPI’s resources in science, technology, and mathematics by pursuing the Sufficiency well beyond the minimum requirement.

<table>
<thead>
<tr>
<th>Areas Available</th>
<th>Faculty Consultants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology and Biotechnology</td>
<td>E. Overström</td>
</tr>
<tr>
<td>Biomedical Engineering</td>
<td>C. Sotak</td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>R. Datta</td>
</tr>
<tr>
<td>Chemistry and Biochemistry</td>
<td>J. Dittami</td>
</tr>
<tr>
<td>Civil and Environmental Engineering</td>
<td>F. Hart</td>
</tr>
<tr>
<td>Computer Science</td>
<td>D. Finkel, M. Gennert</td>
</tr>
<tr>
<td>Electrical and Computer Engineering</td>
<td>F. Looft, H. Hakim</td>
</tr>
<tr>
<td>Industrial Engineering</td>
<td>S. Johnson</td>
</tr>
<tr>
<td>Interdisciplinary Studies</td>
<td>R. Vaz</td>
</tr>
<tr>
<td>Mathematical Sciences</td>
<td>B. Vernescu</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>G. Tryggvason</td>
</tr>
<tr>
<td>Physics</td>
<td>J. Norbury</td>
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</table>

### SUFFICIENCY FOR INTERNATIONAL STUDENTS

In order to take full advantage of their opportunity to study in the United States, all international students whose native language is not English must fulfill their Sufficiency requirement through studies conducted in the English language. Exceptions to this policy may be made by the Consultant for Sufficiencies for International Students (CSIS), in the case of students who have had extensive educational experience in the English language, e.g., English-speaking secondary school. The actual sequence of courses should be determined with the advice of the Consultant for Sufficiencies for International Students. Two approaches are suggested:

**BASIC SUFFICIENCY FOR INTERNATIONAL STUDENTS**

Students whose command of the English language is not on the level of that of an undergraduate whose native language is English should begin their program by successfully completing IS 1811 (Writing for Non-native Speakers of English) and IS 1812 (Speech for Non-native Speakers of English). They may then choose three other courses in Art, English, History, Music, or Philosophy/Religion by arrangement with the Consultant (CSIS). Especially appropriate are the various Humanities Concepts courses and IS 1813, American History for International Students. The final Sufficiency project may be done with any Department member who agrees to advise the topic.

**THEMATICAL SUFFICIENCY FOR INTERNATIONAL STUDENTS**

Students who believe that their command of English is sufficient to begin work on the level of the undergraduate whose native language is English should, with the advice of the Consultant (CSIS), select a first course in an area of their likely interest for the final Sufficiency project. Students passing this first course should proceed through the regular Sufficiency sequence leading to a final project with any Department member who agrees to advise their work. If students do not pass this first course, and the instructor in consultation with the Consultant determines that inadequate proficiency in English was a factor, then such students should proceed through the basic Sufficiency for International students outlined above.

### OTHER OPTIONS

**SOCIAL SCIENCE COURSES**

Humans and Arts Sufficiency project advisors may allow students to include one social science course in their Sufficiency sequence on the basis of that course’s suitability to the development of students’ particular humanities themes.

Such a course must be more than “related to” or “in support of” a given theme. It must be at the interface of humanities (normally history) and blend in with certain Humanities and Arts courses. A course in American government, for example, could logically be included in any number of American history sequences.

The inclusion of a social science course in the Humanities and Arts Sufficiency of any student requires the written “advice and consent” of his or her Sufficiency project advisor after the theme has been determined and before the student registers for the course.

One of the following social science courses (and no other) may be included in the Humanities and Arts Sufficiency sequence:

- SS 1301 U.S. Government
- SS 1402 Introduction to Social Psychology
- SS 2207 Creativity and the Scientific Community
- SS 2208 The Society - Technology Debate

**INTERDISCIPLINARY SUFFICIENCY AT THE AMERICAN ANTIQUARIAN SOCIETY**

A unique opportunity for interdisciplinary work in the humanities and arts is offered by the American Studies Seminar sponsored each fall by the American Antiquarian Society. Organized in collaboration with Worcester’s five undergraduate colleges and universities, this seminar focuses on topics that allow students to investigate the Society’s rich holdings in early American history, literature, and culture. The Society’s unparalleled collection of documents is a short walk from the campus. Information on application deadlines and academic credit toward this Sufficiency is available from the WPI Campus Representative to the American Antiquarian Society.

**OFF-CAMPUS SUFFICIENCY OPTION**

WPI offers the option to complete the Humanities and Arts Sufficiency Requirement during one term of study at several Project Centers. Normally, students complete the sufficiency requirement through at least six courses or independent-study projects on campus. However, the “Off-Campus Sufficiency” option allows students to combine at least three courses on campus with one term studying the humanities and arts at a Project Center. Since this one-term project is equivalent to three courses, students may use it to complete the sufficiency requirement.

Off-campus sufficiency projects are available in Germany for the study of foreign languages and in London for other fields. These off-campus sufficiency programs have a flexible format. Students devote themselves to one term studying the history, literature, language or culture at the project site with a WPI faculty advisor. The program
might combine a thematic seminar in an area of the faculty advisor’s expertise with visits to museums, the theatre, musical performances, or cultural excursions. Although themes or areas of emphasis vary from year to year, all off-campus sufficiency projects culminate in a written report in an area of interest to the student.

To be eligible for this one-unit sufficiency project, students must have already completed three courses in humanities and arts before they leave campus. Students may apply to the off-campus sufficiency program before they have taken all three courses. However, students may not participate in the program unless they successfully complete one unit of work in humanities and arts before the term of the project. In addition, students going to any Project Center must complete all of the forms required by the Interdisciplinary and Global Studies Division.

Requirements:

- Students must have completed at least three courses in the Humanities and Arts at WPI, or have earned equivalent course credit approved by the Humanities and Arts Department, before the term of the off-campus sufficiency project. The Department may allow students to count transfer or advanced placement credits toward the three course minimum;
- Students must be accepted into the off-campus sufficiency program by the Humanities and Arts Department, and complete all forms required by the Interdisciplinary and Global Studies Division, in order to register for these projects;
- Students might be required by the faculty advisor to complete a PQP or attend required meetings before the off-campus project;
- Students must submit a written report or paper at the end of the project. Students also may be required to submit written updates at various times in the course of the project. In all cases, the faculty advisor at the project site will determine the precise form of the written requirements;
- Students may be required to give an oral presentation at the end of the project;
- Under normal circumstances, students must complete the project within one term in order to receive the full unit of credit;
- Only members of the Humanities and Arts faculty at WPI may advise off-campus Humanities and Arts sufficiency projects.

Recommendations

All off-campus sufficiency options benefit from advance planning. Discuss the possibility of an off-campus sufficiency with your academic advisor at the beginning of the freshman year. Consult with the WPI faculty who will advise these off-campus projects as early as possible, since they may be able to suggest useful courses or other background resources for the projects. Also keep in mind that three courses are the minimum required, but many students find it advantageous to take additional courses before going away.

The interdisciplinary London sufficiency program is open to students with a background in areas of the humanities and arts besides foreign languages, including art history and architecture, drama/theatre, history, literature, music, philosophy, religion, or writing/rhetoric. After taking at least three courses in any of these areas on campus, you could then go to London to complete your sufficiency project. Some students also have gone to London with this program to study beyond the sufficiency requirement for international studies, history, literature, music, theatre, or other areas.

WPI offers sufficiency programs in the German language at Darmstadt. This program requires completion of foreign language courses through the level of intermediate II or above (2000-level or above) before going abroad. For students who have taken foreign language courses in high school, language placement exams are available during New Student Orientation. Some students with basic foreign language preparation have completed their arts projects in Germany. We welcome a creative approach to off-campus study.

More advanced students may participate these off-campus programs by doing work toward a minor or major. A student who had already completed their sufficiency requirement on campus, for example, might be able to work in the humanities and arts on an Independent Study Project that could count toward minors. Or a student at one of these sites could work on a Major Qualifying Project in fields such as Humanities and Arts, International Studies, or Technical, Scientific and Professional Communication.

The Humanities and Arts Department advertises upcoming project locations and application deadlines at the Global Opportunities Fair each September. Future project opportunities might include other foreign locations or projects that provide the context for an intensive study of humanistic themes associated with particular locales within the United States. Contact the Department of Humanities and Arts for more information.
Social science deals with the behavior of individuals and groups as well as the functioning of the economic and political systems and institutions that shape and control our lives. As such, it offers a perspective that is essential for anyone desiring a well-rounded education.

Therefore, WPI, in common with other colleges, requires some exposure to the social sciences for its graduates. In satisfying the two-course social science requirement, students are free to take courses in any of the traditional social sciences: economics, political science, sociology, and psychology. The social science courses offered at WPI are grouped into two broad categories. The first consists of core courses that introduce students to the social sciences and help them understand the scope and limits of social science approaches and how they might be related to the design of Interactive Qualifying Projects. The second, more advanced, set of courses looks in depth at particular issues and problems, providing students with a more detailed understanding of social science disciplines and their use in social problem solving and interactive projects.

To obtain maximum benefit from their study of social science, students should choose courses that will provide knowledge and skills relevant to their Interactive Qualifying Project. These courses should be taken prior to or concurrent with undertaking the IQP and should be selected, if possible, after the student has identified the general topic area in which his or her interactive project work will be carried out.

More information on the alternatives available and the factors that should be considered in choosing courses to satisfy the social science requirement are presented in the Social Science and Policy Studies section of this catalog, page 176.

AWARDS AND PRIZES

Awards and prizes are determined by the academic department or by selected committees.

COLLEGE AWARDS

SALISBURY PRIZE AWARDS
These historic awards are made to 14 highly meritorious seniors. These awards were established by Stephen Salisbury, a WPI founder and former president of the Board of Trustees.

TWO TOWERS PRIZE
This prize is awarded to the student who, through general academic competence, campus leadership, regular course work and special work in research and projects, best exemplifies a combined proficiency in the theoretical and practical union implicit in the Two Towers concept, which is at the heart of WPI’s Two Towers tradition.

SIGMA XI AWARDS IN ENGINEERING AND SCIENCE
These awards in engineering and science are given to the students and their advisors for the Major Qualifying Projects which are judged to be the best in originality, contribution to the field, professional competence, and for the most useful applications.

PRESIDENT’S IQP AWARDS
These awards are given to student teams whose conception, performance, and presentation of their Interactive Qualifying Projects have been judged outstanding in focusing on the relationships among science, technology, and the needs of society.

PROVOST’S MQP AWARDS
These awards offer recognition to those students who have completed outstanding Major Qualifying Projects as a demonstration of their competency in a chosen academic discipline. Each academic department conducts its own competition to select the winners.

UNITED TECHNOLOGIES CORPORATION MINORITY AWARD
This award is presented to an outstanding minority undergraduate student.

OUTSTANDING WOMEN STUDENT AWARDS
Marietta E. Anderson Award, an award which is presented to the most outstanding woman student in one of the three lower classes who not only has a superior academic record, but also has been a work-study student, participated in recognized extracurricular activities, and has been a volunteer for college-sponsored activities.

United Technologies Corporation and the Society of Women Engineers Award
This award is presented to an outstanding woman undergraduate student.

Funds from an anonymous donor provide the following awards to women students preparing for careers in engineering or science. Awards are based on academic excellence, contributions to the WPI community, and professional goals. The awards are named each year for women who have played significant roles at WPI.

Bonnie-Blanche Schoonover Award, honoring WPI’s former librarian.

Ellen Knott Award, honoring a long-time secretary in the Mechanical Engineering Department.

Gertrude R. Rugg Award, honoring WPI’s late Registrar Emerita.
WILMER L. AND MARGARET M. KRANICH PRIZE
Students who are seniors or completing their junior year will be nominated by faculty for the annual award. The award will go to a student majoring in engineering, science or management who best exemplifies excellence in the humanities and in the full integration of humanities into his/her undergraduate experience. Double-majors who fulfill one major in Humanities and Arts are not eligible.

SPECIAL AWARDS

ALPHA PHI OMEGA SERVICE AWARD

AMERICAN INSTITUTE OF CHEMISTS FOUNDATION
Chemistry and Biochemistry
An award by the New England chapter of the American Institute of Chemists to honor outstanding seniors majoring in chemistry and biochemistry.

AMERICAN SOCIETY FOR METALS: CHESTER M. INMAN '14 OUTSTANDING STUDENT AWARD
Mechanical Engineering
The Worcester Chapter of the American Society for Metals presents $200 to a student for excellence in a Major Qualifying Project dealing with processing or materials science.

HAROLD S. BLACK AWARD
Electrical and Computer Engineering
This award was established in 2001 to honor the memory of inventor Harold S. Black '21. The award is given by the faculty of the Electrical and Computer Engineering (ECE) Department to one or more ECE seniors who have demonstrated outstanding creativity and enthusiasm in engineering problem solving, practical implementation of problem solutions, and exemplary character in their contributions to the welfare of the WPI community.

CENTRAL NEW ENGLAND AIChE AWARD FOR SIGNIFICANT CONTRIBUTION
Chemical Engineering
This award is given to an individual in recognition of significant contributions to the American Institute of Chemical Engineers.

CLASS OF 1879 PRIZE FOR OUTSTANDING PROJECTS IN THE HUMANITIES
Humanities and Arts
This prize is awarded by the Humanities and Arts Department each year to three students for excellent work in Humanities and Arts Sufficiency projects. Sufficiencies must demonstrate exceptional creativity and skill in conceiving, developing and expressing a theme within any discipline in the humanities and arts.

COMMUNITY SERVICE AWARD PRESENTED IN THE MEMORY OF EDWIN B. COGHLIN ‘23
Alumni Office
This award recognizes individuals who have demonstrated an extraordinary personal commitment above and beyond their normal involvement on campus in both academic and extracurricular activities.

COMPUTER SCIENCE OUTSTANDING JUNIOR AWARD
Computer Science
This award is presented to a computer science junior who has an excellent academic record and who shows promise for continuing success.

COMPUTER SCIENCE OUTSTANDING SENIOR AWARD
Computer Science
This award is presented to one or more computer science seniors who have an outstanding record and who have contributed to the enrichment and professional development of fellow students.

JAMES F. DANIELLI AWARD
Biology and Biotechnology
This award, given by the Department of Biology & Biotechnology, honors the memory of Dr. James F. Danielli, a former department head and world-famous scholar.

FRANK D. DEFALCO AWARD
Civil and Environmental Engineering
Award to WPI undergraduate Civil Engineering students who has completed two and one half years towards a B.S., interested in career constructed facilities and a member of ASCE student chapter.

ETA KAPPA NU OUTSTANDING STUDENT AWARD
Electrical and Computer Engineering
The electrical and computer engineering honor society presents this award to the outstanding senior and junior in recognition of their academic achievement and their service to the WPI community.

GENERAL CHEMISTRY ACHIEVEMENT AWARD
Chemistry and Biochemistry
This award is given to the student who has completed the freshman chemistry course with superior academic performance. Department award.

ALLAN GLAZER AWARD
Mechanical Engineering
Established in 1992 by the family and friends of Allan Glazer '47, this award is given to a junior majoring in mechanical engineering who has demonstrated outstanding academic achievement, special ingenuity in problem solving, and enthusiasm for engineering challenges.

GOAT’S HEAD AWARD FOR OUTSTANDING CONTRIBUTION TO THE STUDENT GOVERNMENT ASSOCIATION
Student Government Association
THE ROBERT H. GODDARD AWARD
Physics
Established by the classes of 1908 and 1909 as a memorial to Dr. Goddard, this prize is awarded for outstanding achievement, scholarship, consistent effort and dedication of purpose in both theoretical and experimental areas of physics.

HEALD BROTHERS SCHOLARSHIP
Mechanical Engineering
This scholarship identifies and supports outstanding young men and women who represent, in modern form, the spirit of “Yankee Ingenuity” that characterizes the evolution of the great manufacturing enterprises from the beginnings of the American Industrial Revolution.

ANDREW HOLT MEMORIAL AWARD
Civil and Environmental Engineering
This award is presented to a civil engineering senior who has consistently earned academic honors and who shows excellent promise for success.

STEVEN J. KAHN AWARD
Humanities and Arts
This award is presented to the outstanding senior in the WPI Glee Club in recognition of his contribution, commitment, and unwavering loyalty to the organization.

THE WILLARD ELLIOT LAWTON-SAMUEL JAMES PLIMPTON AWARD
Physics
Established in honor of Professors Lawton and Plimpton, this award is presented to a student who has shown improvement in scholarship, not only in grades but also in depth of understanding.

LINCOLN ARC WELDING FOUNDATION AWARD
Civil and Environmental Engineering
This award recognizes outstanding achievement in solving design, engineering, fabrication, and research problems.

THE ALFRED R. AND JANET H. POTVIN AWARD
Biomedical Engineering
Separate awards are given to the outstanding undergraduate and graduate student in Biomedical Engineering in recognition of their academic performance and their service to WPI and/or the outside community.

MANAGEMENT EXCELLENCE AWARD
Management
This award is given to one or more seniors who have demonstrated ability in courses and projects and who exhibits outstanding promise of future success in the field of management engineering.

CARL F. MEYER IMPROVEMENT AWARD IN CIVIL ENGINEERING
Civil and Environmental Engineering
Established by Professor Emeritus Meyer, this award is presented to the civil engineering senior who has demonstrated the most improvement in academic and professional attitude since entering the department.

RICHARD V. OLSON AWARD
Mathematical Sciences
Established to honor the memory of mathematics Professor Richard V. Olson, this annual award to a WPI sophomore recognizes outstanding performance in basic mathematics courses.

EDWARD C. PERRY AWARD
Mechanical Engineering
This award is given annually to an engineering student or students for an outstanding major qualifying project in the area of mechanical design. The award is made possible through a bequest from Miriam Perry Goll and honors the memory of her father, Edward C. Perry ’04, a design engineer with General Electric Company throughout his professional career.

PI TAU SIGMA AWARD FOR EXCELLENCE
Mechanical Engineering
The mechanical engineering honor society, Pi Tau Sigma, presents this award to the outstanding junior mechanical engineering student.

SENIOR MATHEMATICAL SCIENCES MAJOR AWARD
Mathematical Sciences
This award is presented to the senior mathematical sciences major who has shown outstanding performance and who has made valuable contributions to the WPI mathematical community.

SOCIETY OF MANUFACTURING ENGINEERING SCHOLARS AWARD
ME/Manufacturing Engineering Program
An MFE senior, recommended by the MFE faculty and confirmed by the officers of SME chapter 25, who has demonstrated excellent scholarship, leadership, service, potential to contribute to the profession of Manufacturing Engineering.

The award includes scholarship assistance ($900) for full-time study if the winner enrolls in WPI’s graduate MFE program.

SOCIETY OF MANUFACTURING ENGINEERING UNDERGRADUATE SCHOLARSHIP AWARD
ME/Manufacturing Engineering Program
Awarded to a 1st, 2nd, or 3rd year MFE major, recommended by the MFE faculty and confirmed by the officers of SME chapter 25, who has demonstrated excellent scholarship, commitment, and contribution to the Manufacturing Engineering program at WPI.

SOCIETY OF MANUFACTURING ENGINEERS OUTSTANDING STUDENT AWARD
ME/Manufacturing Engineering Program
The top three MFE majors each year, regardless of year, who have not already received the award.
SOCIETY OF MANUFACTURING ENGINEERS
MQP AWARD
ME/Manufacturing Engineering Program
An MFE major, selected by a panel of practicing manufacturing engineers to have the best MQP in the area of Manufacturing Engineering.

STUDENT-ALUMNI INTERACTION AWARD
Alumni Office
This award is presented by the WPI Alumni Association in recognition of individuals who, through their involvement on campus, have facilitated the continuing development of interaction between students and alumni. Recipients are full-time undergraduate students who have demonstrated extraordinary personal commitment to WPI and the Alumni Association above and beyond the normal involvement on campus.

The award is designed to recognize students who have stepped forward to become leaders in the alumni and student communities and, in doing so, have benefited both WPI students and alumni in a unique and purposeful way.

CHARLES O. THOMPSON SCHOLARS
Academic Advising
Named in honor of the first president of WPI, this honor recognizes outstanding performance by first-year students.

To be eligible for membership, students must receive all A’s and B’s, with a minimum of six A’s, in their academic subjects during the first three terms at WPI. Selections are made in Term D.

A cash award is presented to the outstanding first-year student. Charles O. Thompson Scholars are eligible to apply for this award by submitting an essay to the Office of Academic Advising during D Term.

ACS UNDERGRADUATE AWARD IN ANALYTICAL CHEMISTRY
Chemistry and Biochemistry
Award which is intended to encourage student interest in analytical chemistry and to recognize a student who displays an aptitude for a career in the field. This award is for third-year students.

WALL STREET JOURNAL AWARD
Management
The Wall Street Journal presents this award to a senior with an outstanding record of achievement.