College of Science

Dr. Thomas Storch, Dean
Dr. Ralph W. Taylor, Associate Dean
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Division of Biological Sciences
Dr. Marcia Harrison, Division Head *(harrison@marshall.edu)*
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Division of Physical Sciences
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The College of Science was established in 1976 and is composed of three divisions: Biological Sciences, Physical Sciences, and Mathematics and Applied Science. The three divisions contain the college's six academic departments (Biological Sciences, Chemistry, Engineering, Geology, Mathematics, Physics, and Physical Sciences) as well as programs in Integrated Science and Technology and Environmental Science.

Most departments are housed in the Science Building, a new building with modern classroom and laboratory facilities. Course offerings by all departments within the college are available to science majors and to students in other disciplines who are interested in broadening their skills and knowledge in basic science, mathematics, computers, and engineering.

The College of Science provides and undergraduate curriculum designed to educate students aspiring to be among the finest scientists and engineers in the 21st Century.

MISSION OF THE COLLEGE

Scientific and technologically trained people are essential to our nation's health and prosperity in a rapidly expanding global economy. Students majoring in baccalaureate

degree programs in the College of Science receive a broad education conducive to pursuing a wide range of career options. Course requirements include solid grounding in the student's chosen area of scientific interest along with studies in humanities and the social sciences. Students receive instruction in a learning environment that encourages competency in written and oral communication skills along with the ability to work in groups. Special emphasis is placed on experiential learning through participation in activities such as undergraduate research, internships, or clinical practica. For non-science majors, departments in the College of Science offer a series of courses which focus on enhancing science literacy through instruction in integrated science and practical applications of mathematics.

ADMISSION REQUIREMENTS

College of Science admission requirements for students at the freshman level are higher than what is required for general admission to the university. The ACT scores required for full admission to the College of Science are a minimum mathematics score of 21 and a minimum composite score of 21. For the SAT, a score of 500 in math and a 1000 composite score are required.

Students who do not meet these admission requirements but still wish to pursue a program in the College of Science may gain admission by enrolling in another college and completing the following requirements.

1. Completion of MTH 127 (or MTH 130) and ENG 101 with a grade of *C* or higher.
2. Completion of at least 15 credit hours of college work with a GPA of 2.2 or higher.
3. Transfer students must have a 2.0 GPA and meet the above requirements for the ACT or SAT.

PROGRAMS

The following programs are available through the departments in the College of Science:

Biological Science (B.S.)
Chemistry (B.S., B.S. in Chemistry)
Engineering (two-year curriculum)
Environmental Management (in cooperation with Duke University)
Environmental Science (B.S.)
Forestry (in cooperation with Duke University)
Integrated Science and Technology (B.S.)
Geology (B.S. and B.A.)
Mathematics (B.S.)
Physics (B.S.)

In addition to satisfying the requirements for a specific major, students must meet the college requirements outlined below and the university requirements as described in this catalog.

Students entering any baccalaureate degree program in the College of Science are responsible for meeting four requirements of the Marshall Plan, baccalaureate program

initiatives approved by the faculty and the university president for all students. These initiatives include Writing Across the Curriculum, Computer Literacy, International and Multicultural Studies, and the Capstone Experience. Students in the College of Science are not required to satisfy the 4-hour Integrated Science and Mathematics initiative. Students are to consult with their academic/program advisors or the chairperson of their major departments for guidance in determining the specific details of meeting the above referenced baccalaureate curricular initiatives.

GENERAL COLLEGE REQUIREMENTS

1. Candidates for graduation must apply for graduation through the office of the dean.
2. Candidates for graduation must have a quality point average of 2.0 or higher on all work attempted at Marshall University, and must have an average of 2.0 or higher in their major. Quality point deficiencies in the major cannot be reduced by taking lower division (100/200 level) courses within the major department, except as provided for by the D and F Repeat Rule; exceptions may be allowed by the Department Chairman.
3. A minimum of 128 semester hours of credit is required for graduation. Forty-eight hours must be earned in courses numbered 300-499. Courses transferred from two-year or community colleges cannot be used to satisfy the upper division requirement.
4. The CR/NC option cannot be used: (1) for any course taken to meet the specific requirements for a B.A. or B.S. degree (see below); (2) for any course taken to fulfill the requirements for a departmental major; or (3) for any course taken to fulfill the requirements for a minor (item 5).
5. Candidates must earn at least 12 hours in a minor subject, no more than three of which may be chosen from courses in the 100 series. The minor field may be chosen from any department within the university outside of the major department.
6. During the junior year, and no later than the semester in which they have completed 90 semester hours, students should request an evaluation by the Dean's office to determine if they are making satisfactory progress towards graduation.

Specific Requirements for the B.A. and B.S. Degrees (Do not apply to Engineering Geology area of emphasis, Integrated Science and Technology or Environmental Science)

HUMANITIES

Requirements	*Credit Hours*
I. English 101 and 102, or 201H	6
Students who take either 102 or 201H on a CR/NC basis are required to pass the English Qualifying Examination.	
II. Foreign Language	3-12
Successful completion of 12-hour sequence ending with German 234, Greek 302, Latin 204, French 204 or 264R, Spanish 204 or 264R, or Japanese 204. Students with previous language experience should consult the prerequisites listed in the	

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Course of Instruction of this catalog to determine the appropriate sequence of courses. International students may satisfy this requirement by consultation with the Department of Modern Languages.

III. Communication Studies ..... 0-3 hrs.

Communication Studies 103, 104H or 305. Communication Studies 103 is not required for students who have had high school speech and who can pass a proficiency exam administered by the Communication Studies Department. Communication Studies 305 is open to juniors and seniors who have not had Communication Studies 103.

IV. Literature 6

Courses to be selected from the following:

Classics 230, 231, 232, 233

English-any 300 or 400 level literature course (ENG 354, 360, 377, 378, and other writing courses do not fulfill this requirement)

French 317, 318, 401, 402, 403, 404

German 301, 302, 417, 418

Latin-any 300 or 400 level course

Religious Studies 304, 310, 320, 325, 351

Spanish 318, 319, 321, 402, 403

V. Classics, Philosophy or Religious Studies 2-3

One course to be selected from the following:

Classics any course except 230, 231, 232, 233

Philosophy-any course

Religious Studies-any course except Honors

SOCIAL SCIENCES

1. Courses to be distributed in at least three fields from Economics, Geography, History, Political Science, Psychology, and Sociology and Anthropology 15

Economics-any course

Geography 100, 203

History-any course

Political Science-any course

Psychology-any course for which the student has the necessary prerequisite, except 223 and 417.

Sociology-Anthropology-any course for which the student has the prerequisite except SOC- 344, 345 and 445.

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SCIENCE AND MATHEMATICS

I. Natural and Physical Sciences 12

Courses to be distributed in at least two fields from biological sciences, chemistry, geology and physics.

II. Mathematics, minimum requirement: Completion of one of the following:

MTH 130 or equivalent and one of the of the following:

MTH 122, 140, 225, or MTH 229

See individual program descriptions for specific requirements. All students whose Math ACT score is less than 19 are required to take MAT 097. Credit received in MAT 097 cannot be applied toward the 128 hours required for graduation.

DEGREE PROGRAMS

ACADEMIC POLICIES

For students transferring from another institution into Marshall, the College of Science will permit the application of any appropriate transfer credits accepted by the university to meet general education requirements. For coursework to be accepted as fulfilling upper division requirements, that work must have been earned at institutions accredited to offer junior/senior level courses.

Students transferring into the College of Science from another institution must have a minimum GPA of 2.0. Students who do not have the requisite GPA but still wish to pursue degree work at Marshall must appeal this regulation to the Dean in writing prior to full admission to the College of Science.

Probation - If a student's GPA falls below 2.0 (a quality point deficit of -1 or greater), the student is immediately placed on probation and notified of such by mail. A student has a grace period of one academic year during which the GPA must be raised to 2.0 or greater. If the probation cannot be removed within the stated time, the student will be dismissed from the College of Science.

Academic Suspension - College of Science students who accumulate a quality point deficit of 20 or greater are automatically placed on academic suspension and are disallowed from registering for classes at Marshall University for a period of one year. Notification of suspension will be by certified letter. If there are legitimate reasons for the poor performance (poor health, accident, etc.) the suspension may be immediately appealed in writing to the Dean . The appeal should include a clear proposal and plan for removing the deficit. With permission of the Dean, classes may be attended during summer sessions.

BIOLOGICAL SCIENCES

Dr. Marcia Harrison, Chair
http://www.marshall.edu/biology/
biology@marshall.edu

Professors

Adkins, Binder, Elmore, Evans, Gain, Gilliam, Harrison, Hight, Joy, Kahle, Pauley, Seidel, Storch, Tarter, Taylor, Valluri, Weaks

(continued)

Associate Professors

Bird, Brumfield, Mallory, May, Strait-Holman

Assistant Professors

Somerville

Courses offered by the Department of Biological Sciences are intended to meet the needs of students preparing themselves for careers in the biological and related sciences, or who want a knowledge of the life sciences as part of their general education and/or to satisfy science requirements in other departments or programs.

Majors in the life sciences provide preparation which can lead directly to a variety of careers in industry, government agencies, and the basic and applied health fields. They also provide excellent preparation for pursuing graduate studies leading to professions in the biological and health sciences. All majors require a minimum of 40 hours of coursework in the Department of Biological Sciences. These include 20 hours of core courses, a 2 hour capstone experience requirement (BSC 491) and a minimum of 18-20 hours of electives chosen under the guidance of the faculty advisor to satisfy one of the following majors: Biology; Botany; Environmental Biology; Microbiology; Physiology/ Molecular Biology; Zoology. Additional requirements include the Specific Requirements of the College of Science in humanities and social sciences, and support courses in chemistry, physics, and mathematics listed below:

CORE COURSES

Biological Science 120, 121*, 320, 322, 324 ..... 20 hrs.

CAPSTONE EXPERIENCE: Biological Science 491* ..... 2 hrs.

Chemistry 211, 212, 217, 218, 355, 356, 361 ..... 19 hrs

Physics 201, 202, 203, 204 ..... 8 hrs.

Mathematics 132 or 229 or ..... 5-8 hrs.

two of the following: MTH 122, 130 (or 127), 140, 225, 229

* Students who earn a grade of A or B in BSC 104 and/or 105 prior to declaring a Biology Major may substitute these courses for BSC 120 and/or 121. Students must earn a grade of *C* or better in BSC 120 & 121 (*B* or better in BSC 104, 105) and a *C* or better in CHM 211 and 212 before they can enroll in any upper-level BSC course except BSC 227, 228 and 250.

It is the responsibility of each student to consult his/her adviser regarding details of meeting the capstone requirement.

MAJORS

Biology

The biology major is intended for students wanting a broadly based, flexible background in the life sciences. Any BSC course at the 200 level or above (except 227, 228, 250, or 485-488) can be used to satisfy the minimum of 18 hours of electives.

Botany

A major in botany prepares students who wish to enter graduate programs which emphasize plant biology and it is an appropriate major for those who seek positions in

government agencies where a special knowledge of plant science is required. Botany majors must complete a minimum of 18 hours selected from the courses listed below:

BSC 405 - Economic Botany
BSC 415 - Plant Morphology
BSC 416 - Plant Taxonomy
BSC 418 - Mycology
BSC 419 - Plant Anatomy
BSC 420 - Plant Physiology
BSC 421 - Phycology
BSC 430 - Plant Ecology

Environmental Biology

The major in environmental biology offers opportunities for careers in areas such as environmental health, resource management, and basic and applied ecological research. Eighteen hours of electives must be selected from the following courses:

BSC 302 - General Bacteriology
BSC 401 - Ichthyology
BSC 406 - Herpetology
BSC 408 - Ornithology
BSC 409 - Mammalogy
BSC 410 - Remote Sensing/GIS Appl.
BSC 411 - Dgtl Image Proc/GIS Model
BSC 413 - Principles of Organic Evolution
BSC 415 - Plant Morphology
BSC 416 - Plant Taxonomy
BSC 420 - Plant Physiology
BSC 421 - Phycology
BSC 422 - Animal Physiology
BSC 424 - Animal Parasitology
BSC 430 - Plant Ecology
BSC 431 - Limnology
BSC 445 - Microbial Ecology
BSC 446 - Microbial Ecology Lab
BSC 460 - Conservation of Forests, Soil, & Wildlife

Microbiology

Students completing the major in Microbiology will be prepared for career opportunities in environmental, pharmaceutical, and industrial microbiology. Students will also be prepared to continue specialization at the graduate level in clinical, food and dairy, soil and sanitary bacteriology, as well as industrial microbiology. Eighteen hours of electives must be selected from the following courses:

BSC 302 - General Bacteriology

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BSC 303 - Readings in Immunology
BSC 304 - Methods in General Bacteriology
BSC 418 - Mycology
BSC 421 - Phycology
BSC 424 - Parasitology
BSC 442 - Advanced Microbiology
BSC 445 - Microbial Ecology
BSC 446 - Methods in Microbial Ecology
BSC 450 - Molecular Biology
BSC 452 - Molecular Biology Lab Techniques

Physiology/Molecular Biology

The major in Physiology/Molecular Biology provides preparation for careers in animal physiology, plant physiology, cell biology, medicine and/or medical research. In addition to the biology courses in this major, Introductory Biochemistry (CHM 365) and Introductory Biochemistry Lab (CHM 366), are strongly recommended as supplements. Eighteen hours are required from the following courses:

BSC 300 - Histology
BSC 301 - Vertebrate Embryology
BSC 302 - General Bacteriology
BSC 303 - Readings in Immunology
BSC 304 - Methods in General Bacteriology
BSC 420 - Plant Physiology
BSC 422 - Animal Physiology
BSC 442 - Advanced Microbiology
BSC 445 - Microbial Ecology
BSC 446 - Methods in Microbial Ecology
BSC 450 - Molecular Biology
BSC 452 - Molecular Biology Lab Techniques

Zoology

The major in Zoology prepares students who have career or graduate school interests that emphasize animal biology. It is appropriate for those who plan to enter medicine, wildlife biology, or related fields. Students may select either Invertebrate Zoology (BSC 212) or Vertebrate Zoology (BSC 214) and at least 8 hours from each of the following blocks:

Block 1: Taxonomy/Ecology
BSC 401 - Ichthyology
BSC 406 - Herpetology
BSC 408 - Ornithology
BSC 409 - Mammalogy
BSC 414 - Entomology
BSC 431 - Limnology

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Block 2: Structure/Function

BSC 300 - Histology
BSC 301 - Vertebrate Embryology
BSC 310 - Comparative Vertebrate Anatomy
BSC 422 - Animal Physiology
BSC 424 - Animal Parasitology
BSC 426 - Medical Entomology

Minor Requirements in Biological Sciences

A student may qualify for a minor in Biological Sciences by successfully completing, with at least a *C* average, the following courses: BSC 120, 121, and a minimum of 8 additional hours above the 100 level, including at least one course at the 300-400 level. This is a total of 16 hours.

CHEMISTRY

Dr. Daniel Babb, Chair
http://www.marshall.edu/chemistry/
chemistry@marshall.edu

Professors

Anderson, Babb, Castellani, Hubbard, Larson, Norton

Associate Professors

Schmitz

Assistant Professors

Meadows, Morgan, Price, Rankin

Courses offered by the Department of Chemistry provide a program of studies that allows the individual to:

1. Obtain high quality instruction in chemistry as a scientific discipline.
2. Obtain a sound background in preparation for advanced studies.
3. Meet the qualifications of professional chemists and accrediting agencies.
4. Prepare for a professional career in medicine, dentistry, pharmacy, medical technology, engineering, nursing and other fields.

High school students planning to major in chemistry are advised to take one year of high school chemistry, one year of high school physics, and at least three years of high school mathematics (including geometry, algebra, and trigonometry).

The curriculum and facilities of the department have been approved by the Committee on Professional Training of the American Chemical Society.

Curricula in Chemistry

B.S. Degree, Major in Chemistry: This major in chemistry is intended for students needing a broadly based, flexible science background. The requirements are:

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Requirements		*Credit Hours*
A. Science		64
Chemistry 211, 212, 217, 218, 355, 356, 361, 307 or 358, 345, 448	31-35	
Upper division Chemistry electives	3	
Capstone Experience - Chemistry 491	2-4	
Mathematics through 229 or 140	3-8	
Physics 201-204	8	
Science and Mathematics electives	10-19	
B. General Humanities and Social Science Requirements		42-54
C. General Electives from any college		10-22
Students interested in careers in technical sales, management, and marketing in the chemical industry are encouraged to take the following courses as electives: Economics 250, 253, Marketing 340, 440 or 442; Management 320.		
Total		128

B.S. In Chemistry Degree: This curriculum meets the standards of the American Chemical Society and is recommended for students intending to enter the chemical profession or intending to pursue graduate work in chemistry. Students who successfully complete the requirements for the B.S. in Chemistry degree will receive a certificate from the American Chemical Society indicating that their degree meets the standards of the Committee on Professional Training. If the student takes Chemistry 423 (Environmental Analytical Chemistry) and Geology 425 (Geochemistry) as electives in the B.S. in Chemistry program, the American Chemical Society certification will reflect this as a certification of a B.S. in Environmental Chemistry. The requirements for this degree are:

Requirements		*Credit Hours*
A. Chemistry		51-52 hours
Principles of Chemistry 211, 212, 217, 218	10	
Organic Chemistry 355, 356, 361, 362	12	
Physical Chemistry 357, 358	8	
Analytical Chemistry 345 and either 422, 423, or 426	7-8	
Chemical Information Retrieval 305	1	
Inorganic Chemistry 448	4	
Capstone Experience - Chemistry 491		2-4
Research 401, 402	6	
Seminars 331, 332, 431, 432	CR	
Advanced electives	3	
B. Physics 211, 202, 213, 204 or equivalent		10
C. Mathematics through 231		13-16

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D. General College Humanities and Social Science Requirements 42-54

E. General Electives 0-14

Total 128

Grade Point Average: A grade point average of 2.0 in all required Chemistry courses as well as an overall 2.0 in all Chemistry courses will be required for either degree program.

Computer Skills: Students in either degree program are required to demonstrate their proficiency in the use of computers in chemical applications. This requirement may be met by either passing an exemption exam (given by the department each semester) or by taking CHM 223 or by taking a programming course for a scientifically useful computer language. Any student who fails to pass the exemption exam on the second attempt will be required to fulfill the requirement by completing CHM 223 or an appropriate programming course.

Honors, Research, and Special Programs in Chemistry: The department offers a number of unique enrichment programs outside the above curricula that are open to students in either degree program. All entering students in chemistry should contact either the department office or their advisor for full details.

Minor in Chemistry

The Department of Chemistry awards a minor in chemistry to students who have completed the following courses with a minimum grade of C in each course: CHM 211, 212, 217, 218, and any two additional courses chosen from CHM 307, 345, 355, 356, 357, 358, or 448.

ENGINEERING

Dr. Richard Begley, Chair

http://www.marshall.edu/engineering/
engineering@marshall.edu

Professor

Begley

Assistant Professor

Cartwright

Marshall University offers a pre-engineering program which consists of the first two years of a professional engineering curriculum. To qualify for admission a minimum Math ACT score of 21 is required.

A structured sequence of engineering courses is offered in conjunction with selected supportive courses from other departments of the university. The engineering courses are general in nature, common to many specialized engineering curricula offered in schools throughout the country.

With the possible exception of chemical engineering, where specialized coursework is sometimes offered in the second year, students transferring to professional engineering programs after two years should be able to complete their B.S. requirements in the

normal amount of time. Since requirements may vary slightly for different professional schools, students should meet with the pre-engineering advisor early in their programs to plan their courses of study.

First Year

First Semester	*Hrs.*
CHM 211 Principles of Chemistry I	3
CHM 217 Chem. Lab. I	2
ENG 101 English Composition	3
EG 101 Engr. Graphics	3
EG 107 Engr. Computations	2
MTH 229 Calculus I	5
Elective*	0-2
	18

*Electives may be technical or nontechnical, according to the particular requirements of the chosen program.

Second Semester	*Hrs.*
CHM 212 Principles of Chemistry II	3
CHM 218 Chem. Lab. II	2
ENG 102 English Composition	3
EG 108 Engr. Design	2
MTH 230 Calculus II	4
CSD 203/205 Fortran/C Prog*	3
	17-19

*See program advisor for choice of Fortran or C.

Second Year (All except Chemical or Electrical Engineering Majors)

First Semester	*Hrs.*
EM 213 Statics	3
EM 215 Engr. Materials	3
EG 221 Engr. Economy	3
MTH 231 Calculus III	4
PHY 211 Princ. of Physics	4
PHY 202 or 212 Physics Lab	1
	18

Second Semester	*Hrs.*
EM 214 Dynamics	3
EM 216 Mech. of Deformed Bodies	4
EM 218 Fluid Mechanics	4
MTH 335 Ord. Differential Eq	3
PHY 213 Princ. of Physics	4
PHY 204 or 214 Physics Lab	1
	19

Second Year (Electrical Engineering Majors)

First Semester	*Hrs.*
EM 213 Statics	3
EM 215 Engr. Materials	3
EE 201 Circuits I	4
MTH 231 Calculus III	4
PHY 211 Princ. of Physics	4
PHY 202 or 212 Physics Lab	1
	19

Second Semester	*Hrs.*
EM 214 Dynamics	3
EE 204 Digital Logic Design	3
EE 202 Circuits II	4
MTH 335 Ord. Differential Eq	3
PHY 213 Princ. of Physics	4
PHY 204 or 214 Physics Lab	1
	18

Second Year (Chemical Engineering Majors)

First Semester	*Hrs.*
EM 213 Statics	3
EM 215 Engr. Materials	3
CHM 355 Organic Chemistry I	3
MTH 231 Calculus III	4
PHY 211 Princ. of Physics	4
PHY 202 or 212 Physics Lab	1
	18

Second Semester	*Hrs.*
EM 214 Dynamics	3
EM 218 Fluid Mechanics	4
CHM 356 Organic Chemistry II	3
MTH 335 Ord. Differential Eq	3
PHY 213 Princ. of Physics	4
PHY 204 or 214 Physics Lab	1
	18

TRANSFER TO BACCALAUREATE PROGRAMS IN ENGINEERING

Administrative Bulletin No. 23 of the Board of Trustees establishes policies for transfer of students from pre-engineering programs to baccalaureate programs at West Virginia University and West Virginia University Institute of Technology.

POLICIES AND PRACTICES FOR THE TRANSFER PROCESS

A. Any student (1) who is a resident of West Virginia, (2) who meets the admission standards for a receiving institution at the time they are admitted by the sending institution, (3) who maintains a GPA of 2.0 or higher during the equivalent of four terms (64 credit hours) at a sending institution will be assured admission into a baccalaureate program in engineering at the receiving institution, provided the student has satisfactorily completed all prerequisite courses. Qualified students who have completed fewer than 64 credit hours at a sending institution will be considered for admission to a baccalaureate engineering program at a receiving institution in the same manner as the receiving institution's regular returning students. Students should consult the college handbook of the desired receiving institution for admission requirements.

Students who have completed a pre-engineering program should have completed the following core of courses:

Calculus	12 hrs.
Chemistry	8 hrs.
Physics	8 hrs.
English	6 hrs.
Statics	3 hrs.
Computer Programming	2 hrs.
Graphics	2 hrs.

B. Any student (1) who **is not a resident** of West Virginia, (2) who meets the non-resident admission standards for a receiving institution at the time they are admitted by the sending institution, and (3) who maintains a GPA of 2.0 or higher during the institution will be assured admission into a baccalaureate program in engineering at a receiving institution, provided the student has satisfactorily completed all prerequisite courses. Qualified students who have completed fewer than 64 credit hours at a sending institution will be considered for admission to a baccalaureate engineering program at a receiving institution on a case-by-case basis.

C. Any student who does not qualify under A or B above, but who nonetheless is admitted to a pre-engineering program at a sending institution, must be informed that there is no assurance that he or she will be admitted to a baccalaureate program in engineering at a receiving Institution. These students will be admitted to the College of engineering and to a curriculum if they have completed at least 8 hours of calculus, 8 hours of applicable physics or chemistry, and 4 hours of graphics and computer programming and one semester of freshman composition with an overall 2.5 GPA and a 2.5 GPA in math and science courses. Students who do not meet the minimum transfer requirements, but who demonstrate special aptitude for engineer-

(continued)

ing studies, may request admission to a baccalaureate program in engineering at a receiving institution by written petition to the appropriate administrator at the receiving institution. Although these guidelines are designed to accommodate students who wish to transfer into a baccalaureate engineering program from an approved two-year pre-engineering program, differences in the range and scope of offerings at each institution cannot assure that a student will be able to complete the baccalaureate degree in all fields of engineering within a four-year period.

Any student who is admitted by transfer from a pre-engineering program at a sending institution will be treated by the receiving institution like the receiving institution's regular returning student. Access to student housing and other privileges at the receiving institution will be controlled by the usual offices, in accordance with the institution's standard practices.

All pre-engineering students at a sending institution will have an opportunity annually to consult with academic advisors from the receiving institutions to ensure adequate articulation of engineering program requirements.

The number of slots available in certain high demand programs at West Virginia University may be limited. In these cases, West Virginia University may invite qualified applicants to select another field.

ENVIRONMENTAL SCIENCE

The Bachelor of Science in Environmental Science degree program is a multi-disciplinary program supported by the College of Science, the Lewis College of Business, and the School of Medicine. The degree program provides a broad knowledge of relevant science areas with environmental concentrations in specific disciplines. The Environmental Science degree will prepare students for professional careers including state and federal jobs in natural resource management and environmental protection, and business/industrial jobs in environmental management. It also prepares students for advanced studies in environmental sciences.

The Environmental Science degree consists of a common core of approximately 81 credit hours of science, business, and general education courses, and approximately 48 credit hours in an area of concentration selected by the student for a total of at least 128 semester hours. The exact number of hours in the core and concentration will vary slightly according to the specific courses selected.

The curriculum of the degree program comprises seven sections: I) Orientation to Environmental Science; II) English Composition/Communication; III) Mathematics, Statistics, Computer Science; IV) Humanities and Social Sciences; V) Natural Sciences; VI) Concentration courses; and VII) the Capstone Project. The Capstone Project provides the student an opportunity to apply completed coursework to a relevant project, such as the development of an Environmental Impact Statement, this could take the form of either thesis or internship.

Students will be responsible for meeting the following initiatives, as stated in the Marshall Plan, while completing the Environmental Science degree: Writing Across the Curriculum, Computer Literacy, International and Multicultural Studies, and the Capstone experience.

Environmental Science majors will comply with the College of Science general requirements. The specific requirements for the B.A. and B.S. degrees do not apply to this degree. Please consult the catalog course descriptions for appropriate course prerequisites.

CONCENTRATIONS

One concentration with environmental emphasis will be selected by the student from the following areas:

- Environmental Assessment and Policy
- Geology
- Chemistry

More detailed descriptions for each of the concentrations are available at the College of Science office.

ENVIRONMENTAL SCIENCE CORE COURSES

I.	Orientation to Environmental Science	7
	ES 100 Introduction to Environmental Science	3
	ES 200 Environmental Science Seminar I	2
	ES 300 Environmental Science Seminar II	2
II.	English Composition/Communication	3
	ENG 101 English Composition I	3
	ENG 102 (or 201H) English Composition II	3
	CMM 103 (or 104H) Fund. of Speech Communication	3
	ENG 354 Scientific and Technical Writing	3
III.	Mathematics, Statistics, Computer Science	11-12
	MTH 229 Calculus & Analytical Geometry I	5
	Statistics	3
	Visual Basic OR other comparable course or with approval by the program director	3
IV.	Humanities and Social Sciences	21-24
	ECN 200 Survey of Economics OR ECN 250 Principles of Microeconomics	3
	ECN 405 Environmental Economics	3
	GEO 320 Conservation of Natural Resources or GEO 317, World Geography Problems	3
	PSC 233 Introduction to Public Policy	3
	Electives: Courses to be distributed in at least three fields from History, Literature, Philosophy, Psychology, Religion, Sociology, Anthropology, and Fine Arts	9-12

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Note: Students must satisfy the university requirements for Writing Across the Curriculum (3 hrs.), International Studies (6 hrs.) and Multicultural Studies (3 hrs.) using Sections I-IV above.

V. Natural Sciences 26-27

BSC 120 Principles of Biology I	4
BSC 121 Principles of Biology II	4
CHM 211 Principles of Chemistry I	3
CHM 217 Chemistry I Lab	2
CHM 212 Principles of Chemistry II	3
CHM 218 Chemistry II Lab	2
GLY 200 Physical Geology	3
GLY 210L Earth Materials Lab I	1
PHY 201 General Physics I	3-4
OR PHY 211 Principles of Physics I	
PHY 202 General Physics Lab I	1

Core Credit Hours (Depending on core electives and concentration) 77-82

CONCENTRATION COURSES

VI. Student will select a concentration area 41-44

VII. Capstone Project (in concentration area): 4

Total Hours 128

FORESTRY AND ENVIRONMENTAL STUDIES
Cooperative Plan of Study

Marshall University and the Duke University School of the Environment have entered into an agreement whereby a student may spend three years at Marshall followed by two years at Duke. Students who are accepted by Duke for this program pursue one of two degrees: Master of Forestry (M.F.) or Master of Environmental Management (M.E.M.). At the end of the fourth year (minimum of 24 Duke credits) the student may be eligible for the B.S. degree with a major in Biological Sciences from Marshall University. Following the fifth year (minimum total of 48 Duke credits) students may qualify for one of the two professional Master's degrees.

Students are normally admitted only at the beginning of the fall term.

Applications to Duke University should be submitted by February 15 preceding the fall in which admission is desired. Duke requires the Graduate Record Examination (GRE) for admission. Students should arrange to take the GRE in the first semester of the junior year.

The curriculum outlined below shows the courses required of students who seek admission to Duke as biology majors at Marshall. Marshall requires a quality point average (GPA) of 2.5 or higher for the three years of on-campus work, Students are strongly encouraged, however, to maintain a QPA of 3.0 or higher to qualify for accep-

tance into Duke. Students accepted into the program over recent years have had a mean GPA of approximately 3.3. In the fourth year a sufficient number of hours must be successfully completed at Duke to total 128 when added to those already completed at Marshall.

Forestry and Environmental Studies majors are required to meet the Marshall University College of Science requirements for the B.S. degree and to take the following courses:

Biological Sciences 120 and 121	8 hrs.
Biological Sciences 320, 322, and 324	12 hrs.
Chemistry 211, 212, 355-356, and 361	15 hrs.
Chemistry 217 and 218	4 hrs.
Physics 201, 202, 203, and 204	8 hrs.
Mathematics 225 and 229	8 hrs.
Economics 250	3 hrs.

DEPARTMENT OF GEOLOGY

Dr. Dewey Sanderson, Chair
http://www.marshall.edu/geology/
geology@marshall.edu

Professors

Bonnett, Ghosh, Martino, Sanderson

Programs of study offered by the Department of Geology are designed for individuals seeking a career as an earth scientist. The greatest numbers of geologists are employed by natural resource industries. These include metallic and non-metallic mining companies as well as petroleum, natural gas, and coal companies. New and challenging careers have recently developed in environmental and engineering geology. The majority of graduates in the past few years have found employment with environmental and geotechnical companies. Other employers include geological surveys, and local, state, and federal regulatory agencies. Career opportunities in the teaching profession at the high school and university level may also be available to those with advanced degrees.

The Department of Geology offers 2 degree programs (B.A. and B.S.) which have been recognized and approved by the American Institute of Professional Geologists, a national organization that certifies professional geologists.

The Bachelor of Arts degree in Geology is designed for those who prefer greater curriculum flexibility, are less certain of their career objectives, or who may wish to enter the teaching profession at the junior high or high school level.

The Bachelor of Science degree in Geology is intended for those who wish to directly enter the Geology/Earth Science profession upon completion of the degree or wish to further their education at the graduate level.

The department also offers a Bachelor of Science in Geology with emphasis in engineering geology. This area of specialization is one of several that can be pursued and has recently developed as a formal program with its own specific curriculum. It has been added in order to meet the increasing demand for geoscientists who are trained in the

acquisition, interpretation, and use of earth materials (rock, soil, ground water) for the solution of engineering problems. The program provides geologists with specific training that will enable them to effectively interact with and support engineers. Its curriculum involves a heavy emphasis of coursework in math, physics, and engineering, and completion of a senior thesis. By completing this curriculum, candidates would automatically complete the requirements for a minor in engineering.

The department offers local and distant field trips to provide experience in a variety of natural geological settings. A wide range of coursework is available which can be tailored to meet specific career tracks. Students also have ample opportunity to participate in independent or cooperative research projects with faculty. The Geology Department currently has a working arrangement with the U.S. Army Corps of Engineers which allows students to work part time at the Corps while pursuing their degrees. Geology majors may also participate in Marshall University's cooperative program with the U.S. Army Corps of Engineers. A co-op student's schedule is crafted by the Department of Geology and the Division of the Corps that employs the student. Following the first year, the student alternates semesters of coursework with semesters of work experience. Completion of the cooperative program normally takes five years.

High school students interested in geology as a career option are advised to take one year of chemistry, one year of physics or biology, and mathematics through at least geometry, algebra and trigonometry. Courses in physical or earth science are also highly recommended.

Requirements

All Majors:

Chemistry 211, 212; labs. 217, 218

Biology or Physics -4 hrs. -Biological Science 120 or PHY 201-202

Geology 110 (minimum B grade required) or 200, 210L, 201, 21IL, 212, 313, 314, 325, 430, 451, 451L, 491 and/or 492

Additional requirements for the B.A. Degree Program:

7-8 additional hours of 300-400 level Geology courses and Math 122 and 130, or Math 132.

Total Geology hours: 39-42

Additional requirements for the B.S. Degree:

Math 229; recommended: Mathematics 230, 231 - especially for those planning graduate work.

Biology or Physics -4 hrs. (Total: 8 hrs.) Biological Science 120 and/or 121 and/or Physics 201-203 and/or 202-204

Geology 421 or 423; plus an additional 11-12 hours selected from GLY 418, 421, 422, 423, 425, 426, 427, 455 and 455L, 456 and 456L, 457.

Total Geology hours: 47-50, depending on course selection

Elective Courses: Geology 280, 281, 282, 283, 410, 485, 486, 487, 488.

GLY 485-488 may be substituted for required choices with approval from the Chairman of the Department of Geology.

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Requirements for Engineering Geology area of emphasis:

Mathematics 229, 230, 231 13
Chemistry 211, 212, 217, 218 10
Physics 211, 212 (or 202), 213, 214 (or 204) 10
Geology 200, 210L, 201, 211L, 212, 313, 314, 325, 430, 451, 451L, 455, 455L, 456, 456L, 457; 421 or 423; 45
4 hours from 491 and/or 492 4
Engineering Mechanics 213, 215, 216, 280, 285 14
General Mechanics 107 2
English: 101 & 102 , 354 9
Communication Studies 103 or 104H or 305 or proficiency 0-3
Literature courses to be selected from: 3
Classics 230, 231, 232, 233
English - any 300 or 400 level literature course, except ENG 354
French 317, 318, 401, 402, 403, 404
German 301, 302, 417, 418
Latin - any 300 or 400 level course
Religious Studies 202, 304, 310, 320, 325, 351
Spanish 318, 319, 321, 402, 403
Classics/Philosophy or Religious Studies 2-3
One course to be selected from the following:
Classics - any course except 230, 231, 232, 233
Philosophy - any course
Religious Studies - any course except Honors
Social Sciences: 15
Economics - any course
Geography 100, 203
History - any course
Political Science - any course
Psychology - any course with proper prerequisite *except* 233 and 417
Sociology/Anthropology - any course with proper prerequisite except SOC 344, 345 and 445

A total of 16 hours of engineering coursework is required. Other engineering courses may be substituted (maximum of 7 hours) for the required ones where deemed appropriate by the Geology and Engineering Department Chairs.

The engineering geology area of emphasis will require 4 hours of capstone experience (GLY 491 and/or 492) which will be devoted to a senior thesis or an internship. This will involve a research project that will involve the acquisition, analysis, and interpretation of data related to any topic within the scope of engineering geology. A written thesis and

oral defense will be required which will need the approval by a majority of geology faculty, including the student's thesis director.

Minor in Geology

The Department of Geology awards a minor in geology to any student who has successfully complete, with at least a C average, 12 hours of Geology coursework. At least 9 hours must be in courses at the 200 level or above.

INTEGRATED SCIENCE AND TECHNOLOGY

Dr. William Denman, Acting Director
http://www.marshall.edu/isat/
isat@marshall.edu

Professors

Anderson (CHM), Bellis (PHY), Cusick (MTH), Denman (CMM), Ebanks (MTH), Lancaster (MTH), Little (IST), Oberly (PHY), Silver (MTH)

Associate Professors

Adkins (MTH), Al-Haddad (IST), Woods (CMM)

Assistant Professors

Cartwright (EG), Fet (BSC)

The B.S. degree in Integrated Science and Technology is a new degree program that provides an alternative to traditional programs in science, technology, and engineering. It is integrated in two ways. Individual courses have subject matter from different disciplines integrated into new configurations, moving beyond single-subject courses. In addition, the program itself integrates subjects into a unified sequence of courses that provides a conceptual whole for students. To accomplish this the IST program brings together faculty and subject matter from engineering, chemistry, physics, biological sciences, computer and information science, mathematics, English, communication studies, management, and medicine to create a unique degree program.

The IST degree program has the following objectives:

- To create a more effective method of engaging students by presenting the value and excitement of science and technology in today's world;
- To provide for the development of communication skills throughout the curriculum, thus enhancing each students' potential for successful employment,
- To demonstrate the importance of science and technology to the needs of society and relate the issues of society to those who engage in science and technology-,
- To integrate the use of computers and expert systems as a curriculum tool to teach decision-making, information gathering, and communication
- To provide a broad, interdisciplinary curriculum that will more fully prepare graduates for changing employment opportunities;
- To create future employees who have solid backgrounds in science and technology as well as the communication and people skills necessary to work in a flexible and changing work environment.

Admission Standards

- A composite score on the ACT test of at least 21;
- A mathematics score on the ACT test of at least 21;
- Recommended are at least two years of study in a modern foreign language;
- In addition to two years of algebra, a unit of geometry and a unit of trigonometry or advanced mathematics is also recommended.
- Submission of a separate application form for the Integrated Science and Technology program along with a transcript of high school work.

Program Components

The College of Science General Requirements do not apply to students in the Integrated Science and Technology program. Marshall Plan requirements do apply. The IST program has four major components:

- General education requirements that include communication courses, "connections" courses that examine the relationships between society and science and technology, courses in the liberal arts, social sciences, a modern foreign language, and a public service/volunteerism experience;
- Core courses consisting of analytical methods, instrumentation, and the Issues in Science and Technology block.
- Strategic Sector courses, taken in the Junior year, that allow students to begin work toward their concentration while examining other areas of the program, including courses in management.
- Courses which replace the traditional major. Concentrations conclude with a senior project, a "capstone" experience that can be a thesis, a research project, or a report on an internship. The concentrations in the IST program are Biotechnology, Manufacturing, Environmental Studies, and Information Technology.

The Integrated Science and Technology degree is a four-year program that requires 128 credit hours.

BACHELOR OF SCIENCE DEGREE IN INTEGRATED SCIENCE AND TECHNOLOGY

GENERAL EDUCATION REQUIREMENTS	Hours
Communications	
IST 101 Fundamentals of Communication	4
IST 201 Advanced Communications	4
Connections	
IST 120 Connections 1	2
IST 220 Connections 11	2
Humanities, Arts, and Literature	
PHL 302 Applied Ethics	3

(continued)

Literature 3

(A course in literature from English, Classics or those offered in Spanish, French or German, as well as an appropriate Honors course.)

The Arts: ART 112, MUS 142, or THE 112 2-3

Language and Cross-Cultural Experience 6

Students may meet the language and cross-cultural experience requirement by completing FRN 203 and 204, GER 203 and 204, SPN 203 and 204, or JPN 203 and 204.

Students will be encouraged to meet this requirement through enrollment in a language study program, offered either by Marshall University or another institution, that includes intensive work in a modern foreign language, and that culminates in a work, internship, or mentorship experience in a setting where the student uses the foreign language.

Social Science* 9

Social Science courses are to be distributed in at least three fields chosen from Economics, Geography, History, Political Science, Psychology, and Sociology/Anthropology.

Economics: any course.

Geography: 100,203, 206, 302, 305, 309, 315, 317, 320, 401,402,405,408,410,412,420.

History: any course

Political Science: any course

Psychology: any course except 223 and 417.

Sociology/Anthropology: any course except SOC 308, 344, 345, and 445.

*In selecting a social science course students should be sure they meet the International or Multicultural portions of the Marshall Plan.

Public Service/Volunteer Experience

IST 301 Public Service Experience 1

Each student will participate in a public service or volunteer experience, selected with permission from his or her advisor, which gives the student an experience working in a volunteer capacity with a group, organization, or agency that offers a service to the general public. Such experience should consist of at least 30 contact hours accumulated over a year or less.

Elective Course 3

Each student shall select an elective course, that is not a science or mathematics course, from among those offered by the university, with approval from his or her advisor.

Total Required General Education Hours 40

PROGRAM REQUIREMENTS	Hours
CORE COURSES	
Analytical Methods	14
IST 130 Analytical Methods I	4
IST 131 Analytical Methods II	4
IST 230 Analytical Methods III	3
IST 231 Analytical Methods IV	3
Issues in Science and Technology	14
IST 111 Issues I: Living Systems	4
IST 112 Issues II: Chemistry in the Environment	4
IST 211 Issues III: Modem Production	3
IST 212 Issues IV: Energy	3
Instrumentation	6
IST 160 Instrumentation I	3
IST 260 Instrumentation II	3
Total hours in Core Courses	34
STRATEGIC SECTORS	
Students should choose 24 hours from the following:	
Environmental Science	
IST 320 Nature of Environmental Problems	3
IST 321 Resolution of Environmental Problems	3
Information Technology	
IST 330 Knowledge Engineering Fundamentals	3
IST 331 Intelligent Information Systems	3
Biotechnology	
IST 340 Double Helix: Issues in DNA Technology	4
IST 341 Issues in Human Genetics	4
Manufacturing Systems	
IST 350 Manufacturing Systems	3
IST 351 Automation in Manufacturing	3
Management	
MGT 320 Principles of Management	3
MGT 420 Operations Management	3
Total hours in Strategic Sectors:	24

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CONCENTRATIONS

Environmental Studies

IST 420, Remote Sensing with Geographic Information Systems	4
IST 421, Digital Image Processing and Computer Simulation Modeling	4
IST 422, Field Sampling for Environmental Systems	3
IST 423, Geochemical Systems	3

Information Technology

IST 430 Electronic Commerce	3
IST 431 Systems Engineering	4
IST 432, Database Information Management	3
IST 433, Network Communications	3

Biotechnology

IST 440 Integrated Genetic Systems	4
IST 441 Integrated Metabolic Systems	4
IST 442 Medical Biotechnology	3
IST 443 Industrial Biotechnology	3

Manufacturing

IST 450 Manufacturing Processes	3
IST 451 Material Science in Manufacturing	3
IST 452 Process Capability, Control and Monitoring	3
IST 453 Design for Manufacturability	3

Total hours from a Concentration	12-14
Senior Project	6
Technical Electives	10-12
TOTAL CREDIT HOURS FOR GRADUATION	**128**

COURSE OF STUDY

YEAR ONE

Fall Semester		*Spring Semester*	
IST 101 Fund. of Communication	4	IST 112 Issues II- Chemistry in the Environment	4
IST 111 Issues I: Living Systems	4	IST 131 Analytical Methods II	4
IST 120 Connections I	2	IST 160 Instrumentation 1	3
IST 130 Analytical Methods I	4	General Education Course	3
General Education Course	3	General Education Course	3
	17		

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YEAR TWO

Fall Semester		*Spring Semester*	
IST 211 Issues III: Modern Production	3	IST 212 Issues IV: Energy	3
IST 230 Analytical Methods III	3	IST 231 Analytical Methods IV	3
IST 260 Instrumentation II	3	IST 201 Advanced Communication	4
General Education Course	3	IST 220 Connections II	2
General Education Course	3	General Education Course	3
	15		15

YEAR THREE

Fall Semester		*Spring Semester*	
Strategic Sector Courses	12	Strategic Sector Courses	12
General Education Courses	6	General Education Course	3
	18	IST 301 Public Service Experience	1
			16

YEAR FOUR

Fall Semester		*Spring Semester*	
Concentration Courses	6-7	Concentration Courses	6-7
Senior Project	3	Senior Project	3
IST Electives	6	IST Electives	6
	15		15

MATHEMATICS
Dr. Bruce Ebanks, Chair
http://www.marshall.edu/math/
math@marshall.edu

Professors

Carlton, Cusick, Drost, Ebanks, Hatfield, Lancaster, Peele, Pupplo-Cody, Rubin, Silver

Associate Professors

Adkins, Aluthge, Mitchell

Assistant Professors

D. Denvir, J. Denvir, Feist, Horwitz, Stickles

Instructors

Bedway, Godbey, Stapleton

The Department of Mathematics offers a Bachelor of Science degree program which prepares students for careers in the mathematical sciences and related disciplines. The program provides a solid mathematical foundation which enables students to perform successfully in industrial, business or government positions, or in graduate studies in mathematics or related areas such as engineering and economics. It may also be used to prepare for secondary mathematics certification or for professional programs such as law and medicine.

Mathematics also serves as an essential tool for many other majors, and it plays an important role in the general education of all students. The Department of Mathematics at

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Marshall University makes every effort to help students learn valuable critical thinking and problem-solving skills.

Majors must fulfill the general and specific requirements for the B. S. degree in the College of Science. Students should go to the College of Science dean's office, Science 270, in order to declare a mathematics major. Within the 128 semester hours required for the B. S. degree, the major in mathematics must complete the following coursework:

The program requires the following core courses for all majors:

1. MTH 229, 230, 231, 300, 301, 330, 427, 445, 450, and 491
2. A minimum of two electives from the following list: MTH 335, 340, 411, 428, 443, or 446, at least one of which must be MTH 428 or MTH 446
3. A computer programming course in Visual Basic (IST 160 or CSD 280) or C++ (EG 280)

Transfer students who wish to major in mathematics must complete at least nine hours of 300-400 level coursework at Marshall University.

The American College Test score in Mathematics is utilized for the placement of students. Relevant information regarding such placement is included under prerequisites in the Courses of Instruction. Students wishing to challenge their placement in MAT 097 may do so by taking the Mathematics Placement Exam administered from time to time by the Marshall Community and Technical College.

A student enrolled in Marshall may receive credit for certain courses in mathematics by successfully completing the appropriate examination of the College Level Examination Program (CLEP).

Advanced placement in mathematics is granted on the basis of Educational Testing Service Advanced Placement Test scores. Students who score 4 or 5 on the Calculus AB examination are given credit for Mathematics 130 and Mathematics 229, and those who score 4 or 5 on the Calculus BC examination are given credit for Mathematics 229 and Mathematics 230. Students who score 3 on BC are given credit for MTH 229; those who score 3 on AB are given credit for Mathematics 132.

Teacher Certification in Mathematics

Students interested in pursuing teaching certification in mathematics should see the dean of the College of Education and Human Services.

Master of Arts

The Department of Mathematics also offers an M.A. degree program in mathematics. Graduate assistantships carrying stipends and tuition waivers are available. Please consult the Graduate Catalog for further details.

Minor in Mathematics

The Department of Mathematics offers a minor in mathematics available to all students at Marshall University. Students choosing this minor will find expanded job opportunities in business, education, government, and industry.

This minor can be helpful to students in pre-professional programs in the health sciences. A solid grounding in the fundamentals of mathematics is needed in order to perform satisfactorily on aptitude examinations that must be taken prior to admission to a professional school.

This minor can be used as an important component of a student's preparation for admission to law school.

As student may qualify for a minor in mathematics by successfully completing, with at least a *C* average, the following courses: MTH 229 (5 hours), 230 (4 hours), and a minimum of six additional hours of courses number MTH 225 or higher.

PHYSICS

The Department of Physics and Physical Science offers coursework leading toward the B.S. degree in physics. The physics major must complete all College of Science general requirements for the B.S. degree.

The physics major must complete the calculus sequence through differential equations and a minimum of 38 hours of required coursework in the major. The completion of the B.S. in physics prepares the graduate for graduate school in physics or engineering, medical school, or other professional programs; or for direct employment in government or industrial laboratories, and other technically related fields.

Among the coursework options open to physics and other science majors are applied physics courses which emphasize applications of optics (PHY 440), electronics (PHY 430), and radiation (PHY 450) to the medically related fields.

Additional related programs within the department lead to an A.B. degree with a specialization in physics and/or general science, and an M.S. degree in physical science.

The physics major working to complete a B.S. degree is required to complete:

1. Physics 211, 202, 213, 204, or equivalent.
2. Physics 300, 302, 320, 330, 442, and 491 (the capstone course)
3. Ten additional semester hours of 300-400 physics courses selected from the catalog, including at least 4 semester hours of advanced laboratory courses (Physics 405, 415, 421, 463).
4. Mathematics 229, 230, 231, 335.

Majors in physics must demonstrate to the department faculty fundamental skills in utilizing computers, which include using software packages for data analysis and word processing, interfacing experiments for data collection, and computer modeling. Students lacking these skills can fulfill this requirement by taking appropriate courses which have the approval of the Department of Physics and Physical Science.

Minor in Physics

The Department of Physics awards a minor in physics to students who have completed the following courses with at least a *C* average: PHY 201 (or 211), 202, 203 (or 213), 204, and any two additional physics or physical science courses at the 300-400 level.

PREPARATION FOR PROFESSIONAL CAREERS IN HEALTH SCIENCES

With the emergence of medicine as a science, and the demand by a modern society for better access to all levels of health care, the challenges presented by a career in the health professions today are both formidable and exciting. The student who is contemplating a career in health sciences is required to have a solid foundation in the natural sciences. As a result, students who plan to study in any of the health professions should include in their high-school subjects one and one-half units of algebra, one unit of geometry, one unit of chemistry, and one unit of physics.

There is no bachelor's degree, as such, granted in pre-medicine or any of the other related health sciences. While most pre-professional students major (i.e. work towards the bachelor's degree) in either chemistry or biological sciences, students may major in virtually any field and still apply to a professional school (dentistry, medicine, etc.). However, it should be recognized that a thorough knowledge of the sciences is needed if one expects to perform satisfactorily on aptitude examinations that must be taken prior to applying for admission to a professional school. Thus the following pre-professional health programs, along with basic course requirements, are outlined for the prospective student. The courses listed under each program are considered minimum requirements, and are usually completed during the first two years of undergraduate work.

COMBINED COLLEGE AND PROFESSIONAL DEGREES

The tendency among medical or dental colleges is to require four years of pre-professional preparation, and preference is given to applicants having such preparation.

A student wishing to study medicine or dentistry at a professional school may be granted a leave of absence during the senior year at Marshall University. To secure this leave of absence the student must file a written report in the office of the dean immediately after gaining admission to the professional school and before the termination of coursework at Marshall University. Failure to discharge this responsibility voids candidacy for the degree under this program. At the end of the first year in the professional school the student then is eligible for the baccalaureate degree from Marshall University, provided that all requirements for graduation are met except the completion of a major, and that the student can present certification from the professional school that he/she has successfully completed the first year at the professional school, and that a sufficient number of semester hours of good quality work has been completed to total 128 when added to these earned at Marshall.

At least 96 hours of study must have been completed and a quality point average of 2.0 must have been earned by the student at Marshall University. Candidates for the degree must attend the regular Marshall University commencement, or have permission to graduate "in absentia."

As one can see from examining the various pre-professional programs, undergraduate requirements, aptitude testing examinations, application for admission to a professional school, etc. may vary considerably. Therefore, it is strongly recommended that pre-professional students discuss their programs at least once each semester with one of the following members of the Pre-Professional Advisory Committee: Dr. Daniel R Babb, (Chemistry) Co-Chairman, Dr. James E. Joy (Biology) Co-Chairman, Dr. Mary Etta Hight (Biology), Dr. David Mallory (Biology), Dr. E. Bowie Kahle (Biology), Dr. William Westbrook (Sociology), Dr. Ralph Taylor (Biology).

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PRE-PHYSICAL THERAPY
(Requires completion of a four year BA / B.S. degree)

Courses:

Biological Science (BSC) 120,121 and 227
Chemistry (CHM) 211, 212, 217 and 218
English (ENG) 101 and 102
Mathematics (MTH) 130 or 127, 122 and 225, or 229 and 225
Physics (PHY) 201, 202, 203, 204
Psychology (PSY) 201, 311
Family and Consumer Science 210

Exams:

AHPAT - junior / senior year

Other Courses:

12 hours from Art, English Literature, Languages, Music, Philosophy, Religious Studies or Speech (must be distributed in at least three fields); 6 hours from Economics, Geography, History, Political Science, Sociology (Anthropology)

Other Requirements:

The ability to swim, or courses in swimming, volunteer or work experience in physical therapy.

PRE-VETERINARY MEDICINE (4 years)

Courses:

Biological Science (BSC) 120 and 121
Chemistry (CHM) 211, 212, 217, 218, 355, 356, 361, 365, 366
English (ENG) 101,102
Genetics (BSC) 324
Mathematics (MTH) 130 or 127 and one of the following: 122, 229, 140, or 225
General Bacteriology (BSC) 302
Physics (PHY) 201, 202, 203, 204

Exams:

MCAT, VAT or GRE and GRE Advanced Biology Section

Other Courses:

Follow catalog for degree requirements for a B.S. or B. A.

Recommended Electives:

BSC 322, CL 200, SOC 200, BSC 301

PRE-OPTOMETRY (3 years)

Courses:

Biological Science (BSC) 120 and 121
Chemistry (CHM) 211, 212, 217, 218, also 355, 356, 361
Social Sciences -Any course (12 hrs.)
English (ENG) 101 and 102

(continued)

Mathematics (MTH) 130 or 127 and 122 or 132 (and 140 recommended) or 229; 225
Physics (PHY) 201, 202, 203, 204
Psychology (PSY) 201

Exams:

OAT October or March of sophomore year

Other Courses:

Check carefully catalog of Optometry College. Requirements vary.

Recommended Electives:

CHM 356, 307; MTH 230, 231; PHY 350, 440; PSY 311 or 440; BSC 302, 310, 315

PRE-PHARMACY (2 years)

Courses:

Biological Science (BSC) 120 and 121
Chemistry (CHM) 211, 212, 217, 218 and 355, 356 and 361
Economics (ECN) 250
English (ENG) 101 and 102
Mathematics (MTH) 130 or 127 and 122 and 140
Physics (PHY) 201, 202, 203, 204

Exams:

PCAT November or February of sophomore year

Other Courses:

12 hours from Art, English, Literature, Languages, Music, Philosophy, Religious Studies (must be distributed in at least three fields)

6 hours from Geography, History, Political Science, Psychology, Sociology/Anthropology

PRE-DENTAL (3 or 4 years)

Courses:

Biological Science (BSC) 120 and 121
Chemistry (CHM) 211, 212, 217, 218 and 355, 356 and 361
Economics (ECN) 250, 253
English (ENG) 101 and 102
Mathematics (MTH) 130 or 127 and 122 or 229
Physics (PHY) 201, 202, 203, 204

Exams:

DAT Spring of sophomore year for 3-year students or during junior year for 4-year students

Other Courses:

Follow catalog for degree requirements B.S. or B.A.

Recommended Electives:

ART 101 or EG (General Engineering) 101; BSC 300,301, 310,322,324; CHM 307, 345, 362, 365,366; CL 200; MTH 230, 231; PHY 350, 450; PSY 311, 408, 440

PRE-MEDICINE (3 or 4 years)

Courses:

Biological Science (BSC) 120 and 121

Chemistry (CHM) 211, 212, and 217, 218 and 355, 356 and 361

English (ENG) 101 and 102

Mathematics (MTH) 130 and 122 or 229

Physics (PHY) 201, 202, 203, 204

Exams:

MCAT, generally during the junior year. However, in some cases the student, after counseling with his/her advisor, may choose to take the MCAT during the spring semester of the sophomore year.

Other Courses:

Follow catalog for degree requirements B.S. or A.B.

Recommended Electives:

BSC 300,301,302,310,322,324; CHM 307,345,362,365,366; MTH 230,231; PHY 350, 430, 440, 450; PSY 408, 440