Department of Integrated Science and Technology

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S. Stockwell, H. Way, J. Wilson

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The ISAT department administers the geographic science program (Page 208), the information analysis program (Page 211) and the integrated science and technology program (Page 212).

Geographic Science

Dr. Jack Gentile, Program Manager
Phone: (540) 568-6173
E-mail: gentiljr@jmu.edu
Web site: www.gs.jmu.edu

Mission Statement
The Geographic Science Program empowers, inspires and motivates students to become competent critical thinkers prepared for lifelong learning, who will respond to intellectual challenges with interest, excitement and competence, and who will see themselves as global citizens actively involved in the world around them. The program graduates majors who are confident in their abilities as geographers, prepared for a lifetime of learning in geography, who have the skills to make a professional contribution to the field, to compete successfully in the job market, to successfully pursue graduate degrees and who are highly qualified for careers in research and development -- equipped for long term success as professionals in the field of geography.

Goals
Through the study of geography students will:
• Understand and properly use the terminology and concepts that are central to the discipline of geography, and explain how these concepts evolved over time.
• Effectively use appropriate geospatial technologies to address questions about human interactions within the built or natural environments.
• Be productive participants in research efforts aimed at measuring, describing, analyzing and explaining the underlying processes giving rise to geographic phenomena.
• Work effectively in multidisciplinary teams.
• Evaluate human-environment interactions from holistic point of view that addresses geographic, as well as political, social, economic and ethical factors affecting those interactions.
• Demonstrate civic responsibility and appreciation for culture and physical diversity from local to global scales.

Career Opportunities
The geography major is divided into two concentration areas. Each of these offers a unique set of career opportunities.

Applied Geographic Information Science (AGIS) Concentration
JMU geographic science graduates with an AGIS concentration have been able to gain professional employment with government and industry or to go on to graduate programs. Public agencies where they have found employment include local and regional planning agencies, mapping organizations such as the U.S. Geological Survey and the National Geospatial Intelligence Agency, intelligence agencies such as the CIA, and also in the environmental science field with the U.S. Forest Service, the National Park Service, the Environmental Protection Agency and other agencies. JMU AGIS graduates have also found opportunities in industry with companies such as Earth Satellite Corporation, GeoEye, Lockheed, SPOT Image, Logicom, SAIC, Sanborn, Booz-Allen Hamilton and many others.
Environmental Conservation, Sustainability and Development Concentration

Geographic science graduates trained in resource analysis, environmental conservation and sustainable development have obtained jobs with local, state and federal governments, non-profit organizations, and for-profit agencies. Organizations hire geographers to work in environmental and land use planning, resource management (including hydrology, forestry, wildlife and soil conservation, and recreation management), area or regional specialties, international business, community development, and development of human and natural resources in foreign nations. Many geographic science graduates move on to graduate degrees (master’s and Ph.D.) and become educators in higher education (community colleges and universities) or obtain higher level positions in both the private and public sector.

Private environmental organizations and consulting firms, as well as government agencies, have hired students completing the environmental studies concentration at JMU. Principal employers include the Environmental Protection Agency, the U.S. Forest Service, the National Park Service, U.S. Geological Survey and non-profit organizations including the Nature Conservancy and Peace Corps. Particularly marketable for JMU geographic science graduates is the combination of experiences in the environmental geographies and AGIS.

Co-curricular Activities and Organizations

- Geography Club
- Gamma Theta Upsilon (International Geographical Honor Society)

Degree and Major Requirements

Bachelor of Arts in Geographic Science

Degree Requirements

Required Courses Credit Hours
General Education1 41
Foreign Language classes (intermediate level required)2 0-14
Philosophy course(s) (in addition to General Education courses) 3
Major requirements (listed below) 52
Electives 19-23
120

1 The General Education program contains a set of requirements each student must fulfill. The number of credit hours necessary to fulfill these requirements may vary.
2 The foreign language requirement may be satisfied by successful completion of the second semester of the intermediate-level of the student’s chosen language (typically 232) or by placing out of that language through the Department of Foreign Languages, Literatures and Cultures’ placement test.

Major Requirements

Core Courses Credit Hours
Statistics (ISAT 251 or MATH 220) 3
GEOG 210. Physical Geography 4
GEOG 215. Geospatial Tools I 3
GEOG 216. Geospatial Tools II 3
GEOG 230. Spatial Thinking 3
GEOG 280. Human Geography: The Cultural Landscape 3
GEOG 290. Human Interactions with the Physical Environment 3
GEOG 305. History and Philosophy of Geography 3

Senior Project Sequence 6
GEOG 390. Senior Project Design (1 credit)
Either GEOG 490, GEOG 491 or GEOG 495 (3 credits);
And GEOG 496 (2 credits);
Or
GEOG 499 Honors (6 credits);
Concentration courses

In addition to the geography core courses, students must choose one of the concentrations, listed in the “Concentrations” section.

Bachelor of Science in Geographic Science

Degree Requirements

Required Courses Credit Hours
General Education1 41-44
Quantitative requirement (in addition to General Education) 3
Scientific Literacy requirement (in addition to General Education) 3-4
Major requirements (listed below) 53
Electives 19-23
120

1 The General Education program contains a set of requirements each student must fulfill. The number of credit hours necessary to fulfill these requirements may vary.
2 The math requirement in Cluster 3 is strongly recommended, as is GEOG 200 in Cluster 4.

Major Requirements

Core Courses Credit Hours
Statistics (ISAT 251 or MATH 220) 3
GEOG 210. Physical Geography 4
GEOG 215. Geospatial Tools I 3
GEOG 216. Geospatial Tools II 3
GEOG 230. Spatial Thinking 3
GEOG 280. Human Geography: The Cultural Landscape 3
GEOG 290. Human Interactions with the Physical Environment 3
GEOG 305. History and Philosophy of Geography 3
Senior Project Sequence
GEOG 390. Senior Project Design (1 credit)
Choose one of the following:
GEOG 490. Senior Project I (3 credits)
GEOG 491. International Study (3 credits)
GEOG 495. Internship (3 credits)
Choose one of the following:
GEOG 496. Senior Project II (2 credits)
GEOG 499. Honors (6 credits)

In addition to the geography core courses, students must choose one of two concentrations, listed in the “Concentrations” section. All courses for the major must be taken on a graded basis.

Concentrations

Applied Geographic Information Science Concentration

In addition to the geography core requirements, students in the AGIS Concentration must complete the following course work.

Required Courses Credit Hours
GEOG 366. Geographic Information Systems 3
GEOG 385. Principles of Remote Sensing 3
GEOG 365. Geography and Geospatial Visualization 3
Choose 9 credit hours from the following
GEOG 465. Topics in GIS (3 credits)
GEOG 466. GIS and Geographic Databases (3 credits)
GEOG 467. GIS Project Management (3 credits)

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GEOG 468. Internet Geographic Information Systems (3 credits)  
GEOG 469. Applications of GIS (3 credits)  
GEOG 485. Processing Remotely Sensed Data (3 credits)  
GEOG 486. High Resolution Imagery (3 credits)  

Cognate course (3 credit hours selected from one of the following)  
- GEOG 300. Population Geography  
- GEOG 310. Environmental Issues  
- GEOG 311. Endangered Environments  
- GEOG 315. Field Studies  
- GEOG 320. Human Dimensions of Global Change  
- GEOG 322. Agricultural Systems  
- GEOG 325. Environmental Ethics  
- GEOG 327. Climatology  
- GEOG 331. Geography of Virginia  
- GEOG 332. Geography of Europe  
- GEOG 333. Geography of Russia and the Former Soviet Union  
- GEOG 334. Geography of East Asia  
- GEOG 335. Geography of Africa  
- GEOG 336. Geography of North America  
- GEOG 337. Geography of Latin America  
- GEOG 338. Geography of the Philippines  
- GEOG 339. Geography of the Caribbean  
- GEOG 340. Biogeography  
- GEOG 341. Wilderness Techniques  
- GEOG 342. Management and Protection of Natural Resources  
- GEOG 343. Wildlife Management  
- GEOG 344. Economic Geography and Development Issues  
- GEOG 345. Geography of Poverty  
- GEOG 350. Topics in Geography  
- GEOG/BIO 402. Forest Ecology  
- GEOG/ISAT 429. Sustainability: An Ecological Perspective  
- ISAT 425. Environmental Hydrology  

Courses from the ISAT program, the Department of Computer Science and the College of Business may be used as electives, as approved by the GS operations manager.  

Environmental Conservation, Sustainability and Development Concentration  
The environmental conservation, sustainability and development (ECSD) concentration focuses on the geographical contexts within which people and places interact. Required and elective course work allows students to explore spatial and temporal patterning between human communities and the natural environment at multiple scales. The curriculum addresses global issues such as global climate change and globalization; environment and human interactions including political, economic, physical and ethical factors; human and ecological aspects of sustainable development; natural resource management including energy, forests, wildlife and biodiversity; cultural ecology; regional geography and population issues. 

In addition to the geography core requirements, all students in the environmental conservation, sustainability and development concentration must complete the following course work.  

<table>
<thead>
<tr>
<th>Required Courses</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOG 320. Human Dimensions of Global Change</td>
<td>3</td>
</tr>
<tr>
<td>GEOG 470. Senior Seminar in ECSD</td>
<td>3</td>
</tr>
</tbody>
</table>

ECSD Electives  
Each student selects four courses from the list below. These 300-level courses are identified on their concentration form, which will be reviewed and approved by the ECSD committee. Other courses may substitute for one of the electives with approval of the ECSD committee. 

- GEOG 300. Population Geography  
- GEOG 310. Environmental Issues  
- GEOG 311. Endangered Environments  
- GEOG 315. Field Studies  
- GEOG 322. Agricultural Systems  
- GEOG 325. Environmental Ethics  
- GEOG 327. Climatology  
- GEOG 331. Geography of Virginia  
- GEOG 332. Geography of Europe  
- GEOG 333. Geography of Russia and the Former Soviet Union  
- GEOG 334. Geography of East Asia  
- GEOG 335. Geography of Africa  
- GEOG 336. Geography of North America  
- GEOG 337. Geography of Latin America  
- GEOG 338. Geography of the Philippines  
- GEOG 339. Geography of the Caribbean  
- GEOG 340. Biogeography  
- GEOG 341. Wilderness Techniques  
- GEOG 342. Management and Protection of Natural Resources  
- GEOG 343. Wildlife Management  
- GEOG 344. Economic Geography and Development Issues  
- GEOG 345. Geography of Poverty  
- GEOG 350. Topics in Geography  
- GEOG/BIO 402. Forest Ecology  
- GEOG/ISAT 429. Sustainability: An Ecological Perspective  
- ISAT 425. Environmental Hydrology  

Cognate course (3 credit hours selected from the following courses)  
- GEOG 365. Cartography and Geospatial Visualization  
- GEOG 366. Geographic Information Science  
- GEOG 385. Principles of Remote Sensing  

Minor Requirements  
Geographic Science Minor  
The minor in geographic science consists of the following courses for a total of not less than 19 credit hours.  

<table>
<thead>
<tr>
<th>Required Courses</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOG 210. Physical Geography</td>
<td>4</td>
</tr>
<tr>
<td>GEOG 215. Geospatial Tools I</td>
<td>3</td>
</tr>
<tr>
<td>GEOG 280. Human Geography: The Cultural Landscape</td>
<td>3</td>
</tr>
<tr>
<td>Three additional geographic science courses</td>
<td>9-12</td>
</tr>
</tbody>
</table>

Credit by Examination  
Credit by examination is offered for some courses taught in the program of geographic science. Students who want permission to take an examination must apply to the program director during the first week of the semester.
Information Analysis
Joseph Marchal, Program Director
Phone: (540) 568-2727 E-mail: marchajh@jmu.edu
Noel Hendrickson, Student Adviser
Phone: (540) 568-2627 E-mail: hendrixn@jmu.edu
Web site: http://www.isat.jmu.edu/IA/index.html

Mission Statement
The IA program will prepare students to solve problems in national, international or business intelligence settings. They will apply the principles of logic and reasoning, data mining and data synthesis with the influences of cultural and political factors to arrive at a holistic solution. This requires the student to have a firm understanding of logic, reasoning, and aspects of how the human mind operates (cognitive psychology) joined with an understanding of cultural and political factors that may influence the relevance of data and a solid understanding of different technologies that facilitate the collecting and evaluation of data.

Employment Opportunities
IA students can find employment in an array of government agencies, including the military, as well as select US and multinational corporations.

Bachelor of Science in Information Analysis
Degree Requirements

<table>
<thead>
<tr>
<th>Required Courses</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education1</td>
<td>41</td>
</tr>
<tr>
<td>Quantitative requirement (in addition to General Education)</td>
<td>3</td>
</tr>
<tr>
<td>Scientific Literacy requirement (in addition to General Education)</td>
<td>3-4</td>
</tr>
<tr>
<td>IA foundations and core courses</td>
<td>42</td>
</tr>
<tr>
<td>IA concentration courses</td>
<td>15</td>
</tr>
<tr>
<td>Electives</td>
<td>22</td>
</tr>
</tbody>
</table>

1 The General Education program contains a set of requirements each student must fulfill.

General Education Courses Credit Hours

| Cluster One                                    | 9            |
| Cluster Two                                    | 9            |

GREL 101 Religions of the World recommended

Cluster Three                                    10

GISAT 251 or MATH 220 required

Cluster Four                                     7

GECO 200 required. GPOSC 200 or GPOSC 225 recommended

Cluster Five                                     6

GPSYC 101, recommended

41

Foundation and Core Courses Credit Hours

| IA Foundation Courses                          | 18           |
| IA 200. Introduction to National Security Intelligence |             |
| IA/CIS 210. Introduction to Global Competitive Intelligence |         |
| IA 400. Cognitive Science and Information Analysis |             |
| IA 405. Ethics, Law and Information Analysis    |             |
| IA 440. Seminar in Information Analysis         |             |
| IA 450. Capstone Project in Information Analysis|             |
| Technology and Tools Core Courses              | 12           |
| ISAT 252. Introduction to Programming and Problem Solving |        |
| IA 340. Data Mining, Modeling and Knowledge Discovery |           |
| IA 341. System Dynamics Modeling, Simulation and Analysis |     |

Concentrations
Students must complete either the national security concentration or the competitive intelligence concentration.

National Security
To complete this concentration, students must take the following four national security courses. In addition, three credits must be selected from the competitive intelligence concentration.

National Security Courses Credit Hours

| POSC 348. Politics of Cultural Pluralism          | 3            |
| POSC 430. International Security in the Post Cold-War World | 3          |
| POSC 458. Political analysis in the cross-national perspective | 3          |
| GEOG 375. Political Geography                     | 3            |
| One course selected from the competitive intelligence concentration | 3          |

Competitive Intelligence
To complete this concentration, 12 credits must be selected from either the set of business intelligence courses or the set of global economics perspective courses. In addition, three credits must be selected from the national security concentration.

Business Intelligence Courses

| CIS 430. Database Design and Application           | 3            |
| CIS 463. Business Intelligence                     | 3            |
| Select two of the following:                      | 6            |
| CIS 304. Information Technology                    |             |
| CIS 366. Web Development                          |             |
| ISAT 348. The Multimedia Industry                 |             |
| CIS 424. Computer Security Management              |             |
| CIS 411. Computer Forensics for Business          |             |

One course selected from the national security concentration 3

1 Any additional CIS requirements for these courses will be waived for IA majors.

Global Economic Perspective Courses

| GECO 200. Introduction to Macroeconomics            | 3            |
| ECON 201. Principles of Microeconomics               | 3            |
| Select two of the following:                         | 6            |
| ECON 301. Economics in transition                    |             |
| ECON 312. Comparative economic systems               |             |
| ECON 365. Economic development                       |             |
| ECON 370. International Trade                        |             |
| ECON 372. International Finance and Payments         |             |

One course selected from the national security concentration 3

Additional IA Courses, Requirements and Recommendations

IA 280. Projects in Information Analysis (This is not a required course.)
IA 480. Topics in Information Analysis (This is not a required course.)
GISAT 251. Analytic Methods III: Statistics or MATH 220. Statistics These are GenEd Cluster Three courses required for the IA major. They will be recorded as GenEd, not IA, credits.
All IA majors will be encouraged to do a not-for-credit internship in information analysis.

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Integrated Science and Technology

Dr. Eric Maslen, Head
Phone: (540) 568-2740   E-mail: maslenh@jmu.edu
Web site: http://www.isat.jmu.edu

Mission Statement
The Mission of the Integrated Science and Technology Program is to prepare students for the complex world that awaits them outside the walls of academe. Today’s graduates should be familiar with a broad range of scientific, technological, and social concepts, and empowered with concrete skills that will make them leaders in solving the real human problems that confront advanced societies. The foundational concept of the ISAT Program, which distinguishes it from other science and technology based programs, is its integration of multiple disciplines within a student’s four-year course of study. The unique integrative character of the program is carried by the curriculum content, pedagogy, and departmental culture. We measure our success by achieving the following ten goals:

Goals
- ISAT grads apply and integrate mathematics, physical science, biological science, and technology.
- ISAT grads apply sound experimental methodology.
- ISAT grads understand the professional requirements for the acquisition and use of information and data.
- ISAT grads work effectively in multidisciplinary teams.
- ISAT grads solve technological problems and understand their societal implications.
- ISAT grads understand and apply the principles of professional ethics.
- ISAT grads communicate effectively on social, scientific, and technical matters.
- ISAT grads analyze science and technology within broader global, political, economic and social contexts.
- ISAT grads are autonomous, self-directed learners who recognize the need for lifelong learning.
- ISAT grads use the computer as an effective problem-solving tool.

Co-curricular Activities and Organizations
- ISAT Honor Society
- ISAT LINKS
- JMU Student Chapter, Environmental Management
- JMU Student Chapter, The American Society of Mechanical Engineers
- JMU Student Chapter, Association for Facilities Engineering
- JMU Student Chapter, Association of Energy Engineers
- JMU Student Chapter, Virginia Biotechnology Association
- JMU Student Chapter, Society of Automotive Engineers International

JMU Student Chapter, Society of Manufacturing Engineering
JMU Student Chapter, IEEE Computer Society

Degree and Major Requirements
Bachelor of Science in Integrated Science and Technology

Degree Requirements
While completing the ISAT courses, the student will also pursue the university’s general education curriculum that is required of all students and is a cornerstone of the education received by every student. The required ISAT courses are listed below. A total of 120 credit hours are required for graduation. In addition, a grade equal to or higher than “C-” is required for all ISAT Foundation courses that are prerequisites to other required ISAT Foundation courses before an ISAT major can take that ISAT course.

Credit Hours
Issues in Science and Technology I-IV 13
Social Context of Technology & Science 6
Analytical Methods I-V 17
Strategic Sectors/Concentration 31-33
Senior Thesis/Project 6
General Education courses and electives 1 46-49
1 The General Education program contains a set of requirements each student must fulfill. The number of credit hours necessary to fulfill these requirements may vary.

Major Requirements
The ISAT program offers the Bachelor of Science degree in Integrated Science and Technology and the M.S. degree. See the JMU Graduate Catalog for information on the M.S. program. The B.S. curriculum produces a graduate broadly acquainted with basic science, technology and business principles. All students pursue a common program through their sophomore year that provides a foundation of science and an introduction to its technology applications. Studies are integrated and include mathematics, statistics, physics, chemistry, biology, knowledge-based systems, environmental science, modern production, energy, and the role of science and technology in society. During their junior and senior years, all students pursue deeper study of strategically significant areas of technology that include biosystems, energy, environmental studies, engineering and manufacturing, information and knowledge management, and telecommunications. Each student selects a concentration in any of these areas and pursues additional study in the concentration culminating in a senior project. Students rely heavily upon the computer as a problem-solving tool throughout the curriculum, work in teams extensively and engage in laboratory experiences in the requisite sciences.

Integrated Science and Technology Major with Pre-health Preparation
Students majoring in ISAT desiring to prepare for higher education in health careers (dentistry, optometry, medicine, pharmacy, physical therapy, veterinary) may waive some required ISAT courses if they take equivalent courses required by the pre-health programs.

http://www.jmu.edu/catalog/10
Required Courses for Pre-Health
BIO 114, BIO 214
CHEM 131, CHEM 132
PHYS (140, 150) or (240, 250)
MATH 205, 235 or 231
MATH 220

ISAT Courses Waived
GISAT 1113
GISAT 1112
GISAT 152, ISAT 212
GISAT 151
GISAT 251

These equivalencies are NOT generally granted outside of a pre-health preparation program. Students who begin a preparation but do not finish it may be able to have some of the courses waived. Contact Paul Henriksen, henrikpw@jmu.edu for more information.

First Year Students and Sophomore Courses

Issues in Science and Technology
This sequence of four courses engages students in the practice of science, both to motivate and to provide understanding of science and technology in the context of important current social issues. Current areas from which issues are selected are living systems, the environment, modern production and energy.

Social Context of Technology and Science
This two-course sequence introduces the student to the non-technological issues encountered in science and technology problem-solving, particularly social, ethical, economic and legal issues.

Analytical Methods
This sequence of five courses provides students with basic methods and tools for understanding and analyzing problems in science and technology. Subjects are taught in an integrated manner with applications as the unifying factor. Topics include calculus, elements of the physical sciences, statistics, project management, the computer, knowledge-based systems and instrumentation and measurement.

Junior and Senior Courses
Strategic Sectors in Science and Technology
Students complete 19-21 credit hours of instruction in strategic sectors during their junior year. The strategic sectors, developed from national critical technologies lists, represent areas of current strategic importance in the world economy. The sectors are biosystems, energy, environment, engineering/manufacturing, information/knowledge management, telecommunications and health systems.

Concentration Requirements
Students are provided the opportunity to focus their program of study by taking four additional courses in a particular area of concentration. The current areas for a concentration are as follows:
- Biosystems
- Energy
- Engineering and Manufacturing
- Environment
- Information and Knowledge Management
- Telecommunications

The option is also open for students to tailor their area of concentration with the help and approval of their adviser.

Senior Thesis/Project
This is the capstone experience of the senior year. Working as part of a team of students and interdisciplinary faculty, seniors will propose, develop, manage, analyze and report on a project that addresses some issue of interest within their concentration.
Minor Requirements

Integrated Science and Technology Minor

The minor in ISAT mirrors the major in ISAT by having a breadth component and a depth component. The breadth component is satisfied through nine credit hours in Issues in Science and Technology and the Foundations of Instrumentation and Measurement. The depth component is satisfied through focused study in a concentration area requiring either nine or ten additional credit hours.

Students should note that many courses have ISAT prerequisites outside the minor (although equivalents to ISAT prerequisite courses will be accepted). In planning a sequence of courses for the minor, students are encouraged to meet with an ISAT adviser to ensure that all needed prerequisites will be taken in due course. In addition, before a student pursuing an ISAT minor can take any ISAT course, a grade equal to or higher than “C-” is required for all ISAT foundation courses that are prerequisites for another required course. The minimum requirements for the minor in ISAT follow.

<table>
<thead>
<tr>
<th>Credit Hours</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-10</td>
<td>Choose three courses from the following:</td>
</tr>
<tr>
<td></td>
<td>ISAT 112. Issues II-Environment</td>
</tr>
<tr>
<td></td>
<td>ISAT 113. Issues I-Living Systems</td>
</tr>
<tr>
<td></td>
<td>ISAT 211. Issues III-Modern Production</td>
</tr>
<tr>
<td></td>
<td>ISAT 212. Issues IV-Energy</td>
</tr>
<tr>
<td></td>
<td>ISAT 253. Analytical Methods V: Instrumentation and Measurement</td>
</tr>
<tr>
<td></td>
<td>Choose one of the following sequences:</td>
</tr>
<tr>
<td></td>
<td>Energy</td>
</tr>
<tr>
<td></td>
<td>ISAT 301. Energy Lab (1 credit)</td>
</tr>
<tr>
<td></td>
<td>ISAT 310. Energy Fundamentals (3 credits)</td>
</tr>
<tr>
<td></td>
<td>ISAT 311. Energy in Modern Society (3 credits)</td>
</tr>
<tr>
<td></td>
<td>Environment</td>
</tr>
<tr>
<td></td>
<td>ISAT 302. Environmental Lab (1 credit)</td>
</tr>
<tr>
<td></td>
<td>ISAT 320. Environmental Fundamentals (3 credits)</td>
</tr>
<tr>
<td></td>
<td>ISAT 321. Environmental Projects (3 credits)</td>
</tr>
<tr>
<td></td>
<td>Engineering and Manufacturing</td>
</tr>
<tr>
<td></td>
<td>ISAT 303. Engineering/Manufacturing Lab (1 credit)</td>
</tr>
<tr>
<td></td>
<td>ISAT 330. Manufacturing Systems (3 credits)</td>
</tr>
<tr>
<td></td>
<td>ISAT 331. Automation in Manufacturing (3 credits)</td>
</tr>
<tr>
<td></td>
<td>Information and Knowledge Management</td>
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<td></td>
<td>ISAT 340. Software Development (3 credits)</td>
</tr>
<tr>
<td></td>
<td>ISAT 341. Modeling and Simulation (3 credits)</td>
</tr>
<tr>
<td></td>
<td>Biosystems</td>
</tr>
<tr>
<td></td>
<td>ISAT 305. Biotechnology Lab (1 credit)</td>
</tr>
<tr>
<td></td>
<td>ISAT 350. Biotechnology for the New Millennium I (3 credits)</td>
</tr>
<tr>
<td></td>
<td>ISAT 351. Biotechnology for the New Millennium II (3 credits)</td>
</tr>
<tr>
<td></td>
<td>Telecommunications</td>
</tr>
<tr>
<td></td>
<td>CIS 320. Telecommunications and Information Processing (3 credits)</td>
</tr>
<tr>
<td></td>
<td>ISAT 360. Fundamentals of Telecommunications (3 credits)</td>
</tr>
<tr>
<td></td>
<td>ISAT 399. Instrumentation and Measurement in Telecommunications (1 credit)</td>
</tr>
<tr>
<td></td>
<td>One additional 3 credit Integrated Science and Technology course at the 300 or 400 level</td>
</tr>
</tbody>
</table>

Materials Science Program Minor

The Department of Integrated Science and Technology is a major participant in the university’s Materials Science program. A minor is available in materials science. The materials science minor provides students with an opportunity to increase their research experience as well as develop multidisciplinary skills and knowledge in the science, engineering and application of materials.

Refer to “Cross Disciplinary Programs” for the curriculum and requirements of the materials science minor.

Additional information about the materials science minor may be obtained from the Center for Materials Science in Room 3206 in the HHS Building, or by calling the director at 540-568-2723 or 540-568-8776.

Cross Disciplinary Majors

Biotechnology

In cooperation with the Department of Integrated Science and Technology and the Department of Chemistry, the Department of Biology offers a four-year, interdisciplinary B.S. degree program for a major in biotechnology.

Biotechnology majors must complete 47-53 credit hours of science foundation courses, 17 credit hours of biotechnology transition and core courses, and 15 credit hours of concentration courses. With the advice and approval of a concentration adviser, each student selects the courses for his or her concentration area. Three broad areas of concentrations are suggested to serve a spectrum of student needs and desires. A research concentration would prepare students for graduate school or entry into a research laboratory. An industry concentration would prepare students for entry into the biotechnology industry. A custom concentration can be assembled for a specialized area of study such as bioinformatics, genomics, or agricultural biotechnology.

See “Cross Disciplinary Programs” for more information on the Biotechnology major.

Environmental Information Systems Minor

The Department of Integrated Science and Technology is a major participant in the university’s Environmental Information Systems program. For more information on this minor, see “Cross Disciplinary Programs.”