

The Two and Four Year Internet/Web Programs At Purdue University Calumet

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Abstract

The advent of the Internet has had a profound impact on the traditional two and four year programs in Computer Information Systems (CIS). Purdue University Calumet has recognized this impact and implemented an innovative Internet/Web program and related courses. The program was developed with input from the University's local business/industry advisory committee members. This paper presents new two and four year Internet/Web programs, which give students a strong foundation in basic concepts and a high degree of employability.

Keywords: Information Systems Curriculum, Internet/Web Programs, E-Commerce, E-Business

1. Introduction

Purdue University Calumet offers extensive instruction and programs in the area of Information Systems (IS), ranging from the certificate to the Master of Science degree. Purdue University Calumet has offered IS programs since 1963. These programs have been described by (Maniotes 1973) and by (Mick 1999).

Currently, the Information Systems & Computer Programming (ISCP) department of Purdue University Calumet offers the following:

- 1) A one year Certificate in Office Automation Technology
- 2) A one-year Post-Baccalaureate Certificate in Information Systems
- 3) A two-year Associate of Science (AS) degree in Office Technology
- 4) An Associate of Science and Bachelor of Science in Computer Information Systems
- 5) An Associate of Science and Bachelor of Science in Software Development
- 6) An Associate of Science and Bachelor of Science in Systems and Networking
- 7) An Associate of Science and Bachelor of Science in Software Engineering
- 8) An Associate of Science and Bachelor of Science in Internet/Web
- 9) A Master of Science in Technology – Information Systems

This paper describes new undergraduate two and four year Internet/Web programs, which started in 1999. In addition specific courses as they relate to the programs are described, as well as the challenges faced by the programs.

2. Goals of the Internet/Web

Programs

The goals of these programs are to prepare students to become proficient in:

- 1) System development methodologies to analyze the needs for corporate Web sites.
- 2) Development of corporate Web sites, using a wide variety of languages and tools, including but not limited to C++, Visual Basic, JAVA, HTML, scripting languages, and FrontPage.
- 3) Implementation and maintenance of corporate Web sites.
- 4) Evaluation and recommendation of new technology for corporate Web sites.
- 5) Selection and utilization of appropriate Web server technology.
- 6) Installation, maintenance, and management of Web servers.
- 7) Evaluation and recommendation of Internet solutions to workgroup, enterprise, and inter-enterprise problems and opportunities.
- 8) Intranet and extranet concepts and technologies.

- 9) Evaluation and recommendation of E-Commerce solutions.
- 10) Installation of effective security measures at corporate Web sites.

CIS 217 Object Oriented Programming (Class 2, Lab 2, Credit 3)

The object oriented application development method has replaced structured development techniques as the development method of choice. This course is a continuation of object-oriented program development as it applies to Web development. An overview of object-oriented analysis and design techniques and terminology is presented. Object-oriented programming techniques are implemented using a visual programming environment, such as Visual Basic.

3. The Two Year Internet/Web Program

Currently, the two-year Internet/Web program is designed to produce graduates in the occupation group, whose job titles may be: Web Programmer, Web Developer, and Web Master.

The curriculum of the two-year Internet/Web program is divided into four areas:

- 1) IS, Networks, and computer basic concepts
- 2) Programming Languages used to develop Internet/Web applications
- 3) Organization of business and business applications.
- 4) Supporting sciences and electives

CIS 240 Introduction to Networks (Class 2, Lab 2, Credit 3)

This course is an introduction to computer networks. How networks are used in business and industry environments is explained. The various types of communication equipment and cables used in networks is also explained. The difference between local area and wide area networks is introduced, as well as exploring analog and digital transmission, and the concepts involved in transmitting data. Network design and the implementation of those designs are an integral part of the course. Students use a graphical software package to create network diagrams.

During the first year of the program, as indicated in Appendix A, the students acquire an introduction to Computer Systems, C++ Programming, Systems Analysis and Design, and Networks. In addition, they study such academic courses as English composition, Communication (speech) fundamentals, and Mathematics. In the second year, the students concentrate heavily in web development and programming applications using C++, Visual Basic, JAVA, and HTML. During this second year, students learn about E-commerce applications, and operating systems. In addition, the students continue their related course study in areas such as: basic accounting or marketing principles, the humanities and social sciences.

CIS 241 Web Development I (Class 2, Lab 2, Credit 3)

This course is an in depth study on the Internet and World Wide Web. Topics include intra-, inter, and extranet concepts, security issues, design criteria and other Web aspects. Focus is on teaching skills necessary to design and develop applications for use on the Internet. Students learn how to write HTML, VBScript, and JavaScript code, how to use Microsoft FrontPage, and other tools to create Web pages. In addition, students learn how to use image maps, forms and scripts, frames, animated GIF files, tables, and style sheets. Students complete a semester long project, working as a member of a team.

An important point to keep in mind is that the two-year program emphasizes the practical, rather than the theoretical aspects of the Internet/Web. Strong emphasis is placed on "real-life" laboratory exercises, which are intended to reinforce the student's knowledge of IS techniques by requiring the student to apply them to a broad spectrum of Internet/Web applications. Listed below are some of the pertinent Internet/Web courses with a brief description of each course:

CIS 242 E-Commerce Architecture (Class 3, Credit 3)

This course is an introduction to client/server and Web-based architecture. Topics include the history and evolution of client/server systems, standards, client/server processing models, the role of the client and of the server, middleware, multi-tiered architectures, methods of data distribution, designing a client/server system, distributed RDBMS, transaction processing and E-commerce. New developments, trends and uses for E-commerce are discussed.

CIS 166 Introduction to C++ I (Class 2, Lab 2, Credit 3)

This course is an introduction to programming using C++. Emphasis in this course is on structured programming and top-down design. Topics include identifiers, data types, arithmetic and logical operators, if, if/else, while, for, switch, do/while, functions, arrays, pointers, strings, struct and introduction to classes. (Raoufi 2000)

CIS 263 JAVA Programming (Class 2, Lab 2, Credit 3)

This course is an introduction to the JAVA programming language. The language is used for creating object-oriented software, particularly for applications to be used on the Internet. Students study the structure and style of JAVA and are required to submit extensive programming laboratory exercises.

CIS 266 Introduction to C++ II (Class 2, Lab 2, Credit 3)

This course is a continuation of the CIS166 Introduction C++ I. It provides advanced skills using the C++ programming language. Students should be prepared for an entry-level programming position using C++. Emphasis in this course is on object-oriented paradigm, using C++. Topics include definition of classes, data abstraction, friend member functions, *this* pointer, static class member, operator overloading, inheritance, virtual function and polymorphism, template, exception handling, elementary data structures, reusability, and introduction to standard template library. (Raoufi 2000)

4. The Four Year Internet/Web Program

This baccalaureate program is a two-year “add-on” curriculum, which is open to the associate degree graduates of the Internet/Web program. This program builds on the student’s knowledge of Web development and programming, acquired in the first two years.

As indicated in Appendix B, the baccalaureate program emphasizes the practical aspects of such areas as multimedia for Web designers, object oriented systems analysis and design, database programming and administration, advanced JAVA programming and Web development, Internet/Web security, Web server management, and a senior system development project. The inclusion of many CIS elective courses enables the student to pursue areas of special interest.

Listed below are some pertinent Internet/Web courses with a brief description of each course:

CIS 341 Web Development II (Class 2, Lab 2, Credit 3)

This course is a continuation of the CIS 241 Web Development I. Advanced features and techniques for developing sophisticated Web content, as well as new trends in Web development are covered. Other topics include using advanced multimedia and database and application integration.

CIS 342 Multimedia for Web Designers (Class 2, Lab 2, Credit 3)

The developments on the World Wide Web have created demand for skills in developing multimedia suitable for use in complex Web sites. This course is an introduction to the creation and use of graphics, animation, video and audio on the Web. Students will design, create and deploy several instances of graphics, video and audio on a series of Web pages. Topics include graphics, video, and audio file formats, creating multimedia content, formatting images on Web pages, animation and video, and the use of graphics for purposes such as buttons, dividers, and image maps.

CIS 356 Topics in Database Programming (Class 2, Lab 2, Credit 3)

The computing industry has moved from storing data in individual files to using some form of database system. Current students must have database programming experience to be productive in this modern environment. This course is an introduction to accessing a relational database using a programming language such as C++ or JAVA. The focus is on one language during the semester. Topics include defining and controlling transactions, sequential access techniques, use of primary and secondary keys, cursors, report generation, updating techniques, and dynamic SQL.

CIS 363 Advanced JAVA Programming (Class 2, Lab 2, Credit 3)

This course is a continuation of CIS 263 JAVA programming. Advanced features and techniques for developing sophisticated JAVA programs, as well as new trends in JAVA development are covered. Topics include multi-threading, client/server, database access and exception handling.

CIS 427 System Development Project (Class 3, Credit 3)

As a student approaches the completion of their degree requirements, they should be able to use the skills and concepts they acquired to design, create and deploy a non-trivial computer system or application. This course represents a capstone course that integrates the knowledge, skills and abilities gained through the computer-related courses in the curriculum within a comprehensive system development project.

CIS 441 Web Server Management (Class 2, Lab 2, Credit 3)

The developments on the World Wide Web have created demand for skills in installing and maintaining Web sites and Web server software. This course is a study of the implementation, configuration and maintenance of Web server software. Students will install and configure a Web server. Topics include server layout and design considerations, CGI, and back-end program management, data collection and management, backup and recovery procedures, security and secure transactions and logging and auditing.

CIS 442 Internet/Web Security (Class 3, Credit 3)

Recent events documented in the media reflect the importance of reliable and effective security measures for securing computing facilities and data. This course is a study of existing methods and techniques for securing various components of computerized systems. Topics include types of attacks, monitoring and detection techniques, encryption methods, data security, authentication techniques and current trends in security.

CIS 457 Database Administration (Class 2, Lab 2, Credit 3)

This course covers database administration tasks and techniques. Students will install and implement two relational database management systems. Topics include RDBMS architecture, installation, configuration, creating databases, migrating data, database object management, user account management, tuning and backup and recovery.

5. Business/Industry Advisory Committee

The ISCP department's business/industry advisory committee has grown over the past few years to include individuals from up to twenty varied businesses and industries. Many of these organizations have hired our graduates over the years. An average of fifteen representatives now attend the semi-annual advisory committee meetings. For the past three years, this committee met with the departmental staff every semester to guide the department in the development and enhancement of the Internet/Web programs, courses, laboratory needs, etc. The committee and the department staff have had a professional relationship on fine tuning the programs and discussing what works, what doesn't work, and more importantly why not.

6. Challenges Faced by the Program

Summarized below are some of the challenges faced by the two-year and four year Internet/Web programs. Although some of these challenges may be pertinent to Purdue University Calumet, others are general enough

to apply to other institutions, which have similar academic programs.

1) Staffing

A problem that the Internet/Web staff faces is the constant updating required in their field, as compared to their colleagues in the humanities and liberal arts. It has been said that the half-life of one's Internet/Web knowledge obsolesces every two years, due to the many new developments that are occurring in the field. Recognizing this problem, the staff has been periodically infused with new Internet/Web knowledge through attendance at the following activities:

- a) Summer Institutes
- b) Seminars and courses sponsored by professional organizations and software vendors
- c) By various consulting assignments in business and industry.

Furthermore, the campus library's selection of Internet/Web oriented books and journals has been expanded so as to enable the staff to remain abreast of the latest developments in this ever changing field.

Another problem that has been experienced in recent years concerns the difficulty in hiring experience instructors who possess up-to-date knowledge about the Internet/Web and its associated applications. One of the problems contributing to this difficulty has been the low starting salaries and poor fringe benefits commonly found in the teaching profession.

University administrators must be constantly made aware that Internet/Web staff members have unique problems and additional resources must be made available to compensate for these deficiencies. The demand for competent and experienced Internet/Web instructors is high and the supply has a long way to go to meet demand.

2) Instructional Materials

Currently, good textbooks, student workbooks/manuals, and visual aids exist for the introductory Internet/Web courses and for the programming courses, such as C++, Visual Basic, JAVA, HTML, and XML, which appear in the freshman and sophomore levels of the program. However, good textbooks, student work manuals, and visual aids for the Junior and Senior levels of the program are sparse. The courses which require good student oriented textbooks are: E-Commerce and E-Business architecture, Internet/Web Security, Web Server Management, Advance Web Development, and Multimedia for Web Designers.

The text material for these courses usually consists of reference manuals from software vendors, notes from the instructor, or handouts oriented for experience professionals, rather than for students. More effort needs to be exerted by textbook publishers in producing good student-oriented textbooks for these courses.

3) Funds

Adequate funding is needed to purchase, rent, or lease modern workstations, PC's, laptops, peripheral equipment, and Internet/Web software packages and multimedia devices is a problem faced by Purdue University Calumet.

A question often asked is: "Where will additional funds come from?" We don't think there will be any significant outlays of funds from federal and state government sources. Nor will there be any sizeable student tuition increases.

At Purdue University Calumet, we have partnered with various software vendors to bring in some popular software packages in the program. For example, our faculty have partnered with private corporations to aid in getting accepted into the IBM Partners-In-Education (PIE) program. This program offers cost effective leasing arrangements to acquire iSeries hardware and free software to support E-commerce and Web enabled applications, using their DB2/Universal DBMS and their Websphere, E-commerce development tool. In addition, partnering with companies like Information Builders Incorporated enables the University to utilize DBMS and WebFocus development tools at no cost to the University or its students.

Other software vendors, such as AutoDesk, Inc. enable the University to bring in their AutoCAD software package into the University for student and outside training needs. In addition, the following software products are also being used by multiple departments at the University: Matlab, Electronics Workbench, *Borland C++*, Borland J Builder, Borland Delphi, MathCAD 2000 Pro, RSLogix 5, Emulate 5, OrCAD Layout and Capture, Microsoft Windows 2000 server, Novell Netware 5.1, MASM 6.11, Microsoft Visual Studio (C++, Basic, JAVA). In addition, AutoCAD 2000i, Architectural Desktop r3, Mechanical Desktop r5, Land Development Desktop r2, Autodesk Inventor r4, 3D Studio VIZ r3; Parametric Technologies Pro/MECHANICA, Pro/ENGINEER, Pro/NC-MILL, Pro/FEM-POST, Pro/ASSEMBLY; Adobe Systems PhotoShop 6.0, Imageready 3.0; Macromedia Inc. Freehand 9.0, and Quark Inc. Quark Express software products are also utilized in the other academic departments of the University.

7. Retention Rates of Internet/Web Majors

The ISCP department has made a concentrated effort to retain Internet/Web majors from the freshman level to the sophomore year in all CIS courses. The department has provided for closed labs, instead of open labs, for most CIS courses. Whenever, possible, the department has assigned a full-time instructor, instead of part-time (guest lecturers) instructors, or graduate assistants and teaching assistants. In some cases, the department has also assigned a student assistant (teaching assistant) to help the instructor in the laboratory and to assist in grading the lab or homework exercises. Internet/Web courses that have a lecture/lab format are set to a maximum lecture size of 36 students and a lab size of 18 students.

We have found that retention rates generally are greater with the older, more mature students attending our evening classes, than the typical younger students, who attend the day classes. Retention rates from some of the introductory Internet/Web programming courses in C++ have averaged approximately 60% to 75% during the past two years (Raoufi 2000).

8. Conclusions

Purdue University Calumet is at the cutting edge by spearheading new two and four year Internet/Web programs. For the Fall, 2001 semester, there are currently 112 registered students who have declared their major as Internet/Web. Students are very excited and enthusiastic about these programs, which are the fastest growing programs at the University. These new programs are different than the traditional CIS, IS, MIS, and CS programs. The new Internet/Web programs will teach students about the technical, psychological, and social aspects of developing Web based applications and how these applications interact with the traditional legacy systems. Discussions on how to interact with legacy systems are held with examples of using Active Server Pages (ASP) as the means of accomplishing this function.

Furthermore, students preparing to enter the work force should learn not only the basics, but also combine critical thinking and problem solving skills with knowledge of how the Internet/Web can be used more efficiently by business and industry.

The Internet is here to stay and it is available 24 hours a day. The Web is growing exponentially and so are its users. The demand for trained Web professionals currently exceeds the supply, even with the demise of many of the first generation dot coms. Hence the development of the two and four year Internet/Web programs by Purdue University Calumet to provide graduates with the

skills to design, develop, implement, and deploy Web based applications.

9. Acknowledgements

The authors would like to acknowledge the faculty of the ISCP department who have contributed so much to shape the contents of the Internet/Web programs.

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11. APPENDIX A

**Purdue University Calumet
Information Systems & Computer Programming Department
Associate of Science Degree Internet/Web***

<u>First Semester</u>			Credits
CIS	166	Introduction to C++ I	3
CIS	210	Personal Computer Technology	3
COM	114	Fundamentals of Speech Communications	3
ENGL	104	English Composition I	3
MA	153	Algebra and Trigonometry I	<u>3</u>
			15
<u>Second Semester</u>			
CIS	240	Introduction to Networks	3
CIS	252	Systems Analysis and Design	3
CIS	266	Introduction to C++ II	3
ENGL	105	English Composition II	3
MGMT	154	Algebra and Trigonometry II	<u>3</u>
			15
<u>Third Semester</u>			
CIS	217	Object Oriented Programming	3
CIS	241	Web Development I	3
CIS	253	Applied Database Techniques	3
MGMT	200	Introduction to Accounting	
	OR		
MGMT	224	Introduction to Marketing	3
		Social Science Elective	<u>3</u>
			15
<u>Fourth Semester</u>			
CIS	242	E-Commerce Architecture	3
CIS	263	JAVA Programming	3
CIS	286	Operating Systems I	3
		Humanities Elective	3
		Open Elective	<u>3</u>
			15

TOTAL CREDITS 60

*For the most current course requirements go to the following URL

<http://www.cis.calumet.purdue.edu/programs.htm>

The High School admission requirements to the two year associate degree program are as follows:

- Quality Rank: - Upper 2/3 required. Upper 1/2 recommended.
- Mathematics: - 2 semesters Algebra required. 4 recommended
- 2 semesters Geometry.
- 2 semesters advanced mathematics and minimum of 400 on mathematics SAT
- Lab Science: - 2 semesters.
- English: - 6 semesters.
- Social Studies: - 2 semesters.
- Computer Usage Skills: - An introductory computer course featuring word processing, spread sheets, database concepts, presentation graphics, and Internet usage.

In addition, Humanities and Social Science electives are defined as follows:

Humanities Electives are defined as American History, English Literature, Modern Language, Philosophy, World History, World Literature, or Aesthetics (i.e. Fine Arts, Music, Theater). Social Science Electives are defined as Anthropology, Communications, Economics, Political Science, Psychology, or Sociology.

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Purdue University Calumet Information Systems & Computer Programming Department Bachelors of Science Degree Internet/Web*

<u>Fifth Semester</u>			Credits
COM	341	Web Development II	3
CIS	342	Multimedia for Web Designers	3
CIS		Elective	3
ENGL	302	Publications Design	3
MA	214	Linear Algebra and Linear Programming	<u>3</u>
			15
<u>Sixth Semester</u>			
CIS	323	Object-Oriented Systems Analysis and Design	3
CIS	356	Topics in Database Programming	3
CIS	363	Advanced JAVA Programming	3
CIS		Elective	3
MGMT	225	Fundamentals of Managerial Statistics	<u>3</u>
			15
<u>Seventh Semester</u>			
CIS	442	Internet/Web Security	3
CIS	457	Database Administration	3
CIS		Elective	3
		Management Elective	3
		General Education Elective	<u>3</u>
			15
<u>Eighth Semester</u>			
CIS	427	System Development Project	3
CIS	441	Web Server Management	3
CIS		Elective	3
MGMT	354	Legal Foundations of Business	<u>3</u>
		Natural Science Elective	<u>3</u>
			15

TOTAL CREDITS 60

*For the most current course requirements go to the following URL

<http://www.cis.calumet.purdue.edu/programs.htm>

Also consult the latest edition of the "Graduate and Undergraduate Catalog," Purdue University Calumet, Hammond, Indiana 46323