

A New Approach to Integrate Computer Technology Certifications into Computer Information System Programs

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Abstract

This paper presents a newly designed curriculum model for the computer information systems. It first reviews the history of profession and certifications. It then addresses the characteristics and categories of information technology certifications recognized by industries. The curriculums recommended by ACM and IEEE are reviewed to define core courses for Computer Information System program. Several technology oriented programs at different levels of educational institutions are also evaluated and discussed. Finally a three-step curriculum model is introduced for a Computer Information System Associate Degree program. This three-step curriculum model first connects the undergraduate general study and computer core courses to build students a foundation in information technology. Other computer related courses are then grouped into several small focus programs. The last step of the three step program is designed to bridge students from this academic program to specialized training programs usually offered by a certified training and test center. Ultimately this three-step curriculum model is designed for students to achieve their academic goals and start their preparations for information technology certifications in a two-year associate degree program.

Introduction

With today's dynamic economy it has become obvious that more and more professionals want to get certified in a special area to maintain their competitive edge. For the same reason many students in Computer Information System or Computer Science programs not only want to earn their degrees but want to be prepared to obtain technology certifications in order to meet the increasing demands from industries. Therefore, this requires the computer related curriculums to be designed towards to these goals and to be updated constantly to meet strong demands from both industry and students.

Elements of Professional Development

After studied on several well-established professions, including medicine, law, engineering, and accounting in the past, researchers observed that professions in several different fields follow a professional development path that is fairly similar, regardless of their specific discipline. There are a number of important elements for one to become a profession. Initial professional education is the primary element and foundation. Then

accreditation is the second element. The rest of them are skills development, certification, licensing, professional development, professional societies and code of ethics.

Necessity of IT Professional Certifications

Professionals generally begin their careers by completing a university program in their chosen field, such as computer, medicine, engineering, or law. Then they may choose to pursue other important field, for example, certification. Certifications used to be an option to most of professions. Today there have always been debates on whether or not one should pass a certification test and get certified. There are still a few employers and some educators who see little value in licensure or certification and don't require or encourage it.

But recently it becomes clear for one to get certified in a chosen field in order to establish his public credibility. A certification further establishes credibility when there is a belief that the work of the profession is associated with personal credibility. Clearly, certified professionals who work in industry, government, or education as well as those in private practice satisfy the identified characteristics and are considered professionals regardless of whether or not they have any college degree. Many even believe that successful professionals need practice applying their knowledge before they are prepared to take primary responsibility for performing work in their field. Unlike IT industry in the US, physicians generally have a three-year residency. Certified Public Accountants (CPAs) must work one year for a board-approved organization before receiving their licenses. Professional engineers must have at least four years of work experience. Requiring some kind of apprenticeship assures that people who enter a profession have practice working at a satisfactory competence level.

Now many people realize that to information technology (IT) industry education alone is not sufficient to develop full professional capabilities. They ask whether or not such a level of education is sufficient for status as a professional. More and more people now promote the idea of an education requirement beyond a Bachelor's degree, suggesting a professional-school approach similar to the professions of law, medicine, pharmacy, and others. After completed a college program one would receive additional technical training as well as practice/business training in order to meet the demands of IT industry. Ongoing professional education maintains or improves workers' knowledge and skills after they begin professional practice. It also proves that an IT profession has to maintain his knowledge and skills at the current level and understand the most advanced technology in his field. After a professional's initial education and skills development are complete, ongoing education requirements help to assure a minimum competency level throughout the professional's career. The fact is that some college degree and non degree computer related programs do not even reflect the current technology.

One aspect of professional development is learning appropriate standards of practice. More importantly it helps professional to catch up-to-date technology. People find that requirements for professional development tend to be strongest in professions that work with a rapidly changing body of technical knowledge. This typically applies to IT field. This is extremely important in IT industry because preparation for certifications can help IT professional to have a chance learn the new technology.

Studies on Professional Engineer (PE) Certifications

Many industries have their own certification to measure and prove one has met certain requirement and maintained certain practical knowledge and skills in a field. It may be recognized worldwide, nationwide or by state. According to J. Richard Cottingham, P.E., P.L.S. NCEES President, Engineering in the United States developed out of the British and French traditions. This led to engineering as we know it today, requiring the standard four-year Bachelor of Science degree.

Mr. Cottingham also summarized that professions have the following identifying characteristics:

- High Academic Standards
- Continual Renewal of Knowledge
- Service for Society
- Personal Responsibility for Work
- Display of Self-Confidence
- Exercise of Judgment and Discretion
- Predominantly Intellectual Work
- Regulated/License Usually required
- Dedication beyond Pecuniary and Personal Considerations.

ACM and IEEE Viewpoints on IT Certifications

As an important organization, IEEE promotes concepts of certification to educational institutions. IEEE categorizes occupational certification into three areas:

- Certifications granted by organizations or professional associations, such as the IEEE Computer Society
- Industry or product-related certifications, such as Novell Certified Engineer
- Certifications granted by government agencies that train for specific jobs then validate that learning and ability to perform that job can be demonstrated.

ACM suggests that institutions may implement their own guidelines in such a way as to allow students to target one or more of vendor-specific or non-vendor-specific certification tests. They may also design tests toward a broader body of knowledge. ACM also works on guidelines to help students completing the programs and prepare for a specific certification test.

But because the IT industry changes rapidly, ACM make no recommendation with respect to the role of certification tests should have. Each institution that offers a program based on ACM guidelines should establish its own mission and purpose, in cooperation with its local needs, to help students best prepare themselves for not only starting a career, but continuing with it. The role of certification testing should be examined, evaluated, and determined by those in charge of implementing the program.

ACM also suggests that every institution should be keeping the curriculum up to date. Once institutions implement programs of this nature, they must keep them current to be a meaningful source of employees for IT-related jobs. Colleges should keep plans current

through a comprehensive plan that includes ongoing professional growth and development for faculty and staff, continuous curriculum revision, periodic review, assessment and replacement of equipment and associated resources, and ongoing evaluation and updating of instructional methodologies and teaching materials. Such efforts require institutional commitment and support, and must precede hand-in-hand with advances in technology and in the IT workplace. An active industry advisory council, together with ongoing feedback from graduates and employers, provides an important mechanism to ensure that this occurs. These industry partnerships can provide many forms of support to the two-year college, including curriculum advice, industry training materials, in-service opportunities for faculty, a source of adjunct faculty, equipment donations, supplemental funding, student internships, placement opportunities, and recognition of program excellence.

Benefits of IT Certification

There are several hundred of certifications in IT field. The number of technical certifications available to IT professionals has exploded from nearly 200 to 400 in only 3 years. More than a million of these credentials have been earned. For many, a product-specific certification, such as Novell, Microsoft or Linux certifications address needs for very specific knowledge and job requirements. The Computer Society saw the need to cut across all products and drill down to the body of knowledge that gives definition to the constellation of computer-related certifications.

To those IT professionals who have exposure or experience to different segments, wish to put the pieces together and tie everything together with a completeness and interdisciplinary advantage they may choose a number of certifications to prove to their employers and customer that they do have sufficient training experience and skills to work in a field where a specific skill is highly required.

Benefits for becoming certified may come in the form of:

- Additional knowledge and skills that allow you to move into a new area or perform your current job more effectively
- Exposure to the latest software, equipment or other knowledge-based advantages you might not otherwise have
- Increased level of expertise
- Contact and networking with top-performing professionals in your field, around the world
- Customer confidence based on your evidence of qualifications and suitability for the task at hand or project put out for bids.

But there are some disadvantages as well:

- Certification is not licensure or accreditation
- Certification can be offered by different organization, vendor, institution, and school. So there is no single standard
- Certification is recognized by one employer and may not be recognized by another employer
- Certification has to be updated when technology changes and it is common that the same certification has to be validated every 2 or 3 years

- Some Certification has high value at one time but it may lose its value very soon, especially there are more and more people get certified. Some certification is a nationally-accepted and recognized credential. But some are not.

Computer Information Systems Programs

In US there are many Computer Information Systems program at both bachelor and associate degree levels today. Program names vary from simply Computer Science, Computer Information Science or Computer Science and Engineering to Computer Information Systems, or even in general, called Information Technology.

Among these programs most are designed for general study in Computer and Information Technology fields in order to build students a solid foundation in Computer Information Technology. They typically include a collection of fundamental concepts in areas, such as, Computing History and Environment, Computer Hardware, Computer Software, Computer Programming, Networking and Data Communication, Database, Software Engineering, Security, Ethics and so on.

Many traditional colleges offer the Computer Information Systems programs at both Associate and Bachelor degree levels. Most of these programs are designed to cover the basic theory or every aspect of computer information technology. Their goals are to help students to build a broad of knowledge in a variety of fields so that graduates from these programs can get many different types of positions in IT workplace. There are not many hands-on trainings included in these programs. Nor are there any special skill training designed for these programs. As a result, graduates need to get practical trainings before they can work independently or become productive. But those graduates can start from their strong theoretical foundations to build their future in IT workplace either towards to any other specific field or to a higher level.

On another hand some programs are designed to concentrate on a specific field, such as network administration, PC technician, Help Desk technician and Customer Service technician. Furthermore, some of these programs are designed for students to get intensive training on their preparations for a specific IT certification. This type of program is usually popular among two-year programs typically at some community colleges.

There is another type of training programs which are solely designed for students to gain their knowledge in a special field or a special product. This type of training classes do not require lengthy lecture and class time is very flexible. They meet requirements for those people whose job only requires them to know a specific technology. They may know how to use specific products very well. But he may not understand why a similar product works or how it works.

These specially designed programs are most likely designed for one of industry recognized certification, for example, CCNA. So students in this program will have an intensive training on CISCO networking equipments. Even though CISCO is a major manufacturer in network router and switch, it does not make all equipments for network and telecommunication industry. Or it means a person who gets a CISCO CCNA

certification can not have his knowledge on all the networking equipments because of the lack of understanding the fundamental theory.

Certifications and Training

According to ACM (Association for Computing Machinery) “Guidelines for Associate Degree Programs to Support Computing in a Networked Environment”, a sampling of job titles for graduates is identified in the Appendix A:

In general, associate-degree programs are designed to prepare graduates for jobs and careers in supporting computing field. These job titles can be classified into several categories, such as, PC Support, System Administration, Computer Operation, Web Development, Software Development, Help Desk and so on.

There are many IT certifications today. They usually fall into two basic categories. One is vendor-specific, for example, CISCO CCNA. The other is platform independent, for example, CompTIA A+. Appendix B lists most recognized IT certifications.

Most of vender-specific certifications are relatively new and most of them are based on vendor’s one specific product or a serious of products. So it is crucial to have a working knowledge on the specific products and hands-on training on these equipments is required for preparation on these certifications. There are several important components as below:

- Broad Theoretical Bases
- Instant Updates in Industry Trends
- Strong Practical Problem Solving Skills
- Constant Updated Knowledge and Skills
- State-of-art Labs

There are many other ways to help students prepare for certification tests. Beside classrooms and specially designed labs, there are books, CBT (Computer Base Training), video tapes, online training facility, certification boot camps, learning centers, vendor training classes and testing centers.

The Programs and Curriculums recommended by ACM and IEEE

ACM along with other academic organizations, such as IEEE, have recommended several programs and curriculums to encourage and support the implementation of curricula based on these guidelines:

- Use current technologies to disseminate these guidelines
- Foster communication among professionals in the field
- Identify and share instructional methodologies, curriculum materials, and computing resources
- Provide for continual updating and revision of these guidelines.

It is clear that students and employers will benefit from the implementation of these guidelines in a curriculum. Students will benefit by studying current concepts, methodologies, and practices that have immediate application to the workplace. The

education and skills training students will obtain in programs that implement these guidelines will qualify them for fulfilling jobs in the kind of positions cited early.

Existing Certification Programs at Some Colleges and Training Centers

Many traditional two-year community colleges already offer many varieties of training courses to help students prepare for certifications. For example, Howard Community College offers Computer Support Technology for Certificates of Proficiency. It is clear that industry certifications have been created by Microsoft, Cisco and other organization to provide a way for people to prove their mastery of a subject or a specific product by passing a test. For instance, a person passing the Microsoft exams on Office software would hold an Office Specialist Certification. This is an industry recognized certification and will make a person become a valuable candidate for a position where his certification and skills will be greatly appreciated.

Furthermore, The Computer Support Technology Certificates of Proficiency at Howard Community College are groups of focused credit courses to prepare students for various technical positions. The courses have been structured so that students are also prepared to sit for various industry certification exams. This path provides students with the opportunity of earning college credits and of taking the industry certification exams. Its programs focus on CISCO and A+, two of most popular IT certifications.

Ivy Tech Community College also chooses the similar approach to divide its associate degrees to become several sub-programs. Each program focuses on one or several specific IT fields. In each field there is a certification that students look for.

It is very interesting to see many traditional four-year colleges have also started their own certificate training programs to meet the needs, for example, Penn State University, University of Arizona, California State University at Fresno and so on.

The traditional computer science programs usually offer many courses to build students a solid foundation. With this solid foundation a student understand the theory behind the technology. When technology changes most of students is capable of adapting those changes and updating their knowledge accordingly. In general students from traditional four-year programs have their ability to make their adjustments better when technology changes. But the traditional programs usually do not include any practical training useful for IT certifications. Most of faculties do not have industry working experience or do not know current industry requirements. This will definitely cause their difficulty to update their course contents, teach students most advanced technology and IT industry trends. This type of program causes students lack of industry touch.

The third type of programs is the traditional technology oriented program and they are designed to help students to work in a specific field, such as, network technology. Therefore students in this program spend most of their time on network technology and plan to become a network technician after graduation. Most of these programs are offered by the community colleges and are two-year programs toward to an Associate Degree.

Many technology programs list their goals on obtaining the vendor-specific product or other technology. They are lack of ability to validate specific skills and demonstrate competencies in the latest technologies. There is also lack of facilities to train students for certain of certificate. Quality of instructors is another problem. The teaching experience level of adjunct faculty is hard to control, especially for those who have their working experience in IT field.

In this type of technology program instructors usually work in IT industry and teaching is their part-time jobs. This type of instructors always emphasize the most advanced technology and like to teach students how to utilize advanced technology to solve practical problem since they are familiar with advanced technology at their workplace. Unfortunately they do not pay their attention on the theoretical background of technology or teaching method. As a result this type of program is good fit to those who have already had working experience and want to become an expert on one specific technology. But it does not help students learn any fundamentals of technology.

Our Approach and Goals

In general the Associate Degree in Computer Information Systems (ASCIS) will provide students with a good grasp of today's primary technological skills along with an appreciation for the wider world through instruction in the liberal arts. Students will learn to manipulate modern computer systems and will become acquainted with popular software packages. They will also learn to think critically, develop an appreciation for excellent customer service, and build good communication skills, within a Christian world view. A graduate of Indiana Wesleyan University with an Associate Degree in Computer Information Systems will be more than a technician; he or she will be prepared to be a life-long learner.

Our associate degree program is designed to prepare graduates for jobs and careers in position supporting computing field. It also help to open the minds of students to the larger world through instruction in the liberal arts, which ties together the themes of servant-leadership, a Christian world view, and technological innovation. Appendix C lists a number of goals of this program.

Job Skill Analysis and Criteria's on Certifications

By utilizing ACM job descriptions and investigating local IT job market these guidelines define a knowledge base in computing. Increasingly, IT has become critical to the operation of many organizations. Workers in this field must demonstrate ethical behavior and professionalism, adhere to codes of conduct, safeguard confidentiality, and respect privacy. Employees must understand the importance of taking responsibility for their actions and being accountable to the organization, and they must be aware of the impact their work has on the entire organization. Any implementation of these guidelines must ensure that graduates can work within framework. So understanding of a specific technology and being certified is not the only factor in a program. More importantly human communication and life long learning skills are critical to success of a graduate's career.

A series of analyses fill in the real-world job tasks and knowledge topics that support successful job performance and are relevant to the certification in order to determine which IT certifications are popular in local IT workplace. Once the certification tracks are designed we did the detailed design work for each IT field with emphasis on human communication and life long learning skills.

For most certifications it is necessary to think of job analysis as a two-stage process. Usually it is necessary to conduct surveys before the design of the overall certification program. You can think of a certification program as consisting of one or more tracks. A track is a sequence of required or recommended experiences. At certain points in the track testing is required. With this information in hand we can choose certifications that meet the needs of our students.

To a certification program it provides important information about the job roles and tasks. These roles and tasks are determined by local job market and employers. Some of certifications are for experts in the use of the products and in the services offered by the company. People certified are capable of doing to be successful on the job and to provide benefit to the company or organization.

After careful survey, job market analysis, role analysis and practice analysis these certifications are identified as useful to students in different circumstances. However, they all have the same thing in common, which is to help students to get certified and at the same time to get an associate degree.

ASCIS Program

The ASCIS degree is composed of nine computer information systems courses and twelve liberal arts courses. This three-step program first connects the general study and computer related courses to build students a theoretical foundation in computer information technology field and other critical fields. We then categorize computer related courses into several subject focus programs. Each program is designed toward to one certain certification, for example, Microsoft system administration A+ certification, SUN Solaris System Administration or CISCO network engineer CCNA certification. At the end of the program the third step will help students to bridge to training programs offered by a certified training and test centers. This bridge will further help students develop their practical technology skills and enhance their test skill as well. This special three-step curriculum is designed for students to achieve their academic goals, learn the most advanced technology and complete their preparations for technology certifications.

The focus areas are classified as several categories for different skill sets, different certifications and different working fields as below:

- Computer Service Technician
- Computer Help Desk
- Network Engineer
- System Administration
- Microsoft Office and other software
- Database Administration

The Core courses will build students a foundation which will help them continue their studies in the following steps. At Indiana Wesleyan University there is a successful team to build students a broad view of world, communication and management skill. Appendix D lists four categories of courses.

The three-step program consists of:

Step 1. Computer Information Systems Foundations

These courses will help students build their foundations in CIS. Importantly, its goal is to have the graduates be equipped to adapt to changes in this world and in computer technology field.

Step 2. Special Focus Courses

These courses help students understand how to perform installation, configuration, maintenance, troubleshooting, and documentation services in selected environments towards to the certain certifications; assist in training end users; evaluate and recommend software and hardware; implement extensions to applications programs; and create and maintain a multi-functional Web-based environment.

Step 3. The Bridge to State-of-art Training Programs

It is very hard to start and maintain a state-of-art certification program while also focusing on academic side. The contents of training programs often change when technology changes every 2 or 3 years. Sometime certain authorized training facility can get updated by the vendors immediately after vendor's products update. Those facilities are usually the vendor sponsored and contracted training facilities or vendor's training facilities. It is almost impossible for a college to maintain this type of lab environment for students to prepare for their exams for financial and other reasons. But this type of facility plays important roles in helping students prepare for their certification exams. So it is the students' best interests to ask help from this type of training specialists after they complete their first two steps in their program, theoretical studies and Certification Exam Preparation Phase One. So they may complete their Certification Exam Preparation Phase Two at these training facilities with help of training specialists. Many times these training facilities are also test centers. This will also benefit students' preparation for their certification exams.

So it is very natural for an academic program to work with a professional training and test center to provide students with the best possible solutions so that students can obtain the best results from their two-year program.

It is obvious that we do have a very strong academic team with many years high education experience and a complete academic curriculum for students. But we do not have the ability to set up and maintain a state-of-art training facility for our students. On the other hand the professional training facilities do have their strength on training and test, which we do not have. Therefore combination of these two becomes a natural

solution in order to use both sides' strength in one program. This way will ensure students to get the best results from this program. This bridge will definitely play an important role in helping students to smoothly reach their academic and career goals at the same time.

There are many IT specialized training centers in this country. These training specialists delivers IT training program and tests around the world for industry leaders such as Microsoft, Cisco, Oracle, SUN Microsystems, Intel and so on.

Besides acting as a testing site these training and test centers also specialize in the technology-enabled testing and assessment market by a truly collaborative approach to service that centers on tailored solutions for their test partners and their clients. By deploying breakthrough innovations in technology that deliver accuracy, convenience, flexibility and credibility across the testing value chain, they provide better solutions to students with the depth of their experience and solutions on training and certification exams than any college programs.

One important advantage that students will usually get from this type of training and test facility, not from their traditional school programs is the training and test centers usually keep diverse industry alliances and they have direct access to the capabilities of other industry-leading businesses. This will guarantee them to get any update from the IT alliance at earliest stage and become very well prepared when a new technology or an upgrade of a technology comes to market.

Presently there are many training and test centers across the country, for example, Pearson VUE and Prometric. From time to time these training facility focus on strengthening learning outcomes through testing and assessment. They constantly make their efforts on strengthening academic training curriculums, enhancing corporate training programs for clients and providing traditional licensures and certifications programs, such as Cisco certification, with more robust testing capabilities to improve the quality of the exam and testing outcomes.

Therefore teaming up with those IT training and test leader will help out students to get access to most advanced training and most current test material. This further strengthens our program and helps us focus on the academic education and preliminary training with our limited resources. From this unique bridge connecting our academic program and these training specialist students will get the maximum benefits from every step in order to become successful.

Faculty

A quality faculty is established and maintained through a series of actions. These include looking for full-time and adjunct instructors that are competitive with industry, setting up comprehensive and well-funded staff development programs, supporting for travel and participation in professional organizations, offering opportunities for interaction with business and industry, and the provision of the associated instructional support system.

At a time when with a significant shortage of skilled computer personnel confronts business and industry, finding and keeping qualified faculty is difficult. Ongoing training for faculty and technical staff is essential for a program of this type to remain current. Faculty and support staff must be knowledgeable about emerging technologies. A program of continuous professional growth and development is critical to ensure the instructional programs produce students that meet industry standards. In addition, model staff development programs often include opportunities for faculty to work directly in industry for a specified period of time, participate in vendor-specific certification training, and obtain release time for follow-up activities and curriculum development.

Certified instructors will be the best candidates if they are capable of teaching the theoretical part of a course. Many instructors of this type have their strength on hands-on show in classroom. But they do not pay much attention on teaching students step by step. They tend to think it is easy to learn technology on your own and tend to move fast. So it is very important to clearly define the certain time frame for this type of instructors and enforce them to follow course guidelines.

Program Evaluation and Improvement

Several critical steps are used by adopting ACM and IEEE curriculum recommendations

- Closely watching available certifications
- Following Industry trends and needs
- Analyzing the faculty and student feedbacks
- Implementing faculty training and improvements
- Evaluation, assessment and program upgrade.

Program Timeframe and Improvement

The ASCIS program is a new program with many new concepts. The plan is to launch it in summer 2004. During its first year every course will be closely monitored and at the end of every course the feedbacks from both faculty and students will be collected and evaluated. The evaluation of each course will result in modification of each course and even the structure of the whole program. After a year the whole program will be evaluated based upon the collected data from all the courses. An independent assessment team will conduct most of survey and evaluation.

Conclusion

It is a demand from both industry and students to integrate the certification training into an academic program. This three-step program will help students not only reach their academic goals but also gets in-depth preparations for one or more IT certifications. This new method requires us to efficiently use all the resources and apply them into our program as well. To accomplish that, it is very important to combine our academic teaching strength with specialties of training specialists and training centers. It is also important to constantly update program contents to meet the industry needs. Since this is a brand new program, several evaluations and updates on the curriculum are expected through the first year of the program. It is also expected that there will be major updates after one year.

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Appendix A: A Sampling of IT Job Titles

- Computer Operator
- Computer Repair Technician
- Computer Sales Person
- Computer Technician
- Customer Service Representative
- Desktop Support Technician
- Enterprise Network Manager

- Hardware/Software Installer
- Help Desk Specialist
- Help Desk Supervisor
- Help Desk Technician
- Internet Manager
- Internet Support Specialist
- Lab Computing Coordinator
- Microcomputer Support Specialist
- Microcomputer Technician
- Network Technician
- Network Administrator
- Network Analyst
- Network Cabling Specialist
- Network Installer
- Network Support Specialist
- Network Troubleshooter
- Office Systems Support Specialist
- Operating System Support Specialist
- PC Technician
- Software Support Specialist
- Software Tester
- Software Trainer
- Systems Administrator
- Technical Support Specialist
- Technology Training Coordinator
- User Support Specialist
- WAN/LAN Manager
- Web Architect
- Web Manager
- Web Page Designer
- Web Site Developer
- Web Technician

Appendix B: A Sampling of IT Certifications

- Novell Certified Novell Engineer(CNE) Certification
- Microsoft Certified Professional(MCP) Certification
- CISCO CCNA Certification
- CompTIA A+ Certification
- ORACLE Certification
- Other Certifications

There are many certifications in IT industry and most of them are offered by the vendor to promote their products and also train their employee in sales, technical support, development and even management. For example, Network+, Server+, iNET+, SUN Solris, IBM, CIW, Citrix, CheckPoint, CISSP, Linux and Lotus

Appendix C : A List of ASCIS Program Goals

- To develop an appreciation and understanding of a Christian world view, which includes a servant-leader mentality.
- To inspire students to see the value and necessity of practicing good customer service, within the framework of servant leadership.
- To instruct students in the basics of quantitative skills and logic, preparing graduates to recognize and define problems, and execute solutions.
- To inculcate excellent communications skills, enabling graduates to synthesize data and adequately inform non-technical persons of technological problems and solutions.
- To help students become familiar with hardware and the most popular software programs and to develop a working knowledge of how to provide customers with excellent service through efficient problem solving.
- To make students aware of the connections between current technology and business applications, granting graduates a glimpse of the potential for future possibilities.
- To create a capstone opportunity for students to apply what they have learned in an integrated format.

Appendix D : Four Categories of CIS Courses.

D.1 General Study Courses

- Skilled in effective writing, speaking (making presentations), and conversing;
- Familiar with mathematics, the social sciences, the arts and humanities, and science, consistent
- with the usual standards for a liberal arts education;
- Skilled in problem solving and decision making;
- Experienced in interpersonal skills;
- Exposed to techniques of critical analysis and task management; and
- Accustomed to working in teams.

D.2 CIS Foundation Courses

- Introduction to Computer Information Systems
- Introduction to Programming Concepts
- Project Management and Integration Capstone

D.3 Certification Related Courses

- Network Communications
- Operating Systems Concepts
- Database Concepts
- E-Commerce and Web Development

D.4 The Certification Courses

- Desktop Applications
- Hardware and Software Troubleshooting