College Curriculum

PROGRAMMING CURRICULUM

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This report presents the competency-based curriculum developed for the Bellevue Community College IT Programming Program. The curriculum was translated from the skill standards for the Programmer Analyst career cluster published in *Building a Foundation for Tomorrow: Skill Standards for Information Technology* by the NorthWest Center for Emerging Technologies in 1997.

This report includes the following:

➢ **Program Learning Components**: meaningful categories of related skills and knowledge.

➢ **Learner Program Outcomes**: what the learners must be able to know and demonstrate at the end of the program.

➢ **Key Competencies**: specific, observable knowledge and skills that support and lead to the program learner outcomes.

➢ **Sample Activities**: activities or projects that provide a context for learners to acquire technical and foundation skills and knowledge, with associated competencies and suggested assessments.

➢ **Curriculum Map**: a map that assigns the program outcomes and competencies into specific courses.

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PROGRAM LEARNING COMPONENTS

The Learning Components are meaningful categories of related skills and knowledge that are best taught/learned together and represent logical pieces of curriculum.

Technical Learning Component
Client Programming
Computer Applications
Computer Systems History and Trends
Database Design
Math and Science for Programmers
Network Architectures and Systems
Network Operating Systems
Principles of Accounting
Programming Language – C
Programming Language – C++
Programming Language – SQL
Programming Language – Visual Basic
Quality Assurance
Server Programming
Systems Analysis
Systems Design
Technical Documentation
Testing and Debugging
User Interface Design

Foundation Learning Component
Business Communication
Business Organization and Environment
Client Relations
Problem Solving
Professional Development/ Self-Learning
Professional Environment
Project Management
Proposal Writing
Task Management
Team Work
User Validation

LEARNER PROGRAM OUTCOMES

Learner Program Outcomes are statements that support the Learning Components by describing what students must know and be able to do by the end of the program.

Client Programming – *Technical Learning Component*
➢ Demonstrate the ability to explain and apply the necessary phases of application development in a Client/Server environment, with emphasis on the client component

Computer Applications – *Technical Learning Component*
➢ Demonstrate the ability to use proficiently office software, including word processing, spreadsheet and Internet browser applications
➢ Demonstrate the ability to apply office software applications to solve business problems

Computer Systems History and Trends – *Technical Learning Component*
➢ Demonstrate the ability to discuss the issues affecting the selection of a computer system for a specific environment
➢ Demonstrate the ability to present current computer technology and systems trends

Database Design – *Technical Learning Component*
➢ Demonstrate the ability to create and utilize relational databases, including modeling data, developing queries, customizing forms and reports, using code, creating charts and working with graphics
➢ Demonstrate the ability to explain the importance of databases and information as a commodity in this high-tech age

Math and Science for Programmers – *Technical Learning Component*
➢ Demonstrate the ability to explain and apply basic mathematical processes as they relate to programming; including statistics, logic, relational algebra, number systems, and cost/benefit analysis
➢ Demonstrate the ability to explain and apply basic science processes as they relate to programming; including design of experimentation, data gathering and analysis, sensor performances

Network Architectures and Systems – *Technical Learning Component*
➢ Demonstrate the ability to explain the design characteristics and components of network systems
➢ Demonstrate the ability to design and implement simple network architectures
➢ Demonstrate the ability to perform basic network hardware and software installation and configuration procedures, and troubleshoot basic network problems

Network Operating Systems – *Technical Learning Component*
➢ Demonstrate the ability to explain the characteristics of different network operating systems
➢ Demonstrate the ability to install, use, configure and troubleshoot most commonly used network operating systems

Principles of Accounting – Technical Learning Component
➢ Demonstrate the ability to explain and apply basic accounting principles
➢ Demonstrate the ability to explain how computer applications support the financial workings of a business organization

Programming Language – C – *Technical Learning Component*
➢ Demonstrate the ability to write, compile, debug and execute well engineered and maintainable C programs that effectively meet the application requirements

Programming Language – C++ – *Technical Learning Component*
➢ Demonstrate the ability to write, compile, debug and execute well engineered and maintainable C++ programs that effectively meet the application requirements

Programming Language – SQL – *Technical Learning Component*
➢ Demonstrate the ability to explain and apply the principles of SQL programming

Programming Language – Visual Basic – *Technical Learning Component*
➢ Demonstrate the ability to write, compile, debug and execute well engineered and maintainable Visual Basic programs that effectively meet the application requirements

Quality Assurance – *Technical Learning Component*
➢ Demonstrate the ability to explain and apply quality assurance processes as they relate to programming
➢ Demonstrate the ability to Discuss quality issues in a technology organization

Server Programming – *Technical Learning Component*
➢ Demonstrate the ability to explain and apply the necessary phases of application development in a Client/Server environment, with emphasis on the server component

Systems Analysis – *Technical Learning Component*
➢ Demonstrate the ability to explain and apply the necessary processes, tools and skills used in the systems analysis phase of a project

Systems Design – *Technical Learning Component*
➢ Demonstrate the ability to explain and apply the necessary processes, tools and skills used in the systems design phase of a project

Technical Documentation – *Technical Learning Component*
➢ Demonstrate the ability to select and use technical documentation formats meeting the intended purpose and the guidelines of the organization
➢ Demonstrate the ability to develop effective and accurate technical documentation appropriate to various audiences and purposes

Testing and Debugging – *Technical Learning Component*
➢ Demonstrate the ability to apply debugging and testing tools and techniques
➢ Demonstrate the ability to develop and apply systematic debugging and testing processes

User Interface Design – *Technical Learning Component*
➢ Demonstrate the ability to explain and apply the necessary processes, tools and skills used in effective user interface design

Business Communication – *Foundation Learning Component*
➢ Demonstrate the ability to select and exercise the appropriate communication vehicle for a specific purpose in a professional context
➢ Demonstrate the ability to communicate effectively in technical and business environments

Business Organization and Environment – *Foundation Learning Component*
➢ Demonstrate the ability to discuss contemporary business principles, practices and organization, and a foundation of business terminology
➢ Demonstrate the ability to discuss how computer systems impact the operation and management of business and society

Client Relations – *Foundation Learning Component*
➢ Demonstrate the ability to effectively listen and ask critical questions to identify clients issues and concerns
➢ Demonstrate the ability to resolve clients issues and concerns in a timely and appropriate manner

Problem Solving – *Foundation Learning Component*
➢ Demonstrate the ability to identify and use a wide range of techniques and tools to identify and solve technical problems
➢ Demonstrate the ability to use appropriate communication techniques to correctly isolate and identify a wide range of problems, and communicate resolution plans and/or solutions

Professional Development/ Self-Learning – *Foundation Learning Component*
➢ Demonstrate the ability to identify and close gaps between one's knowledge and skills and those required by the situation
➢ Demonstrate the ability to evaluate one's strengths and build upon them
➢ Demonstrate the ability to identify sources of learning/training most appropriate for the subject and for one's personal learning style

Professional Environment – *Foundation Learning Component*
➢ Demonstrate successful work environment-related attitudes and skills
➢ Demonstrate the ability to establish and maintain professional relationships

Project Management – *Foundation Learning Component*
➢ Demonstrate the ability to explain the purpose of, and participate in all the phases of project management
➢ Demonstrate the ability to use appropriate project management planning tools and methods

Proposal Writing – *Foundation Learning Component*
➢ Demonstrate the ability to explain the necessary elements of a proposal and their respective purpose
➢ Demonstrate the ability to develop a proposal that meets the client's requirements and effectively presents the phases of the project

Task Management – *Foundation Learning Component*
- ➢ Demonstrate the ability to organize multiple tasks in the most effective way and allocate time and energy according to task complexity and priority
- ➢ Demonstrate the ability to evaluate task outcomes and continuously improve organization process

Team Work – *Foundation Learning Component*
- ➢ Demonstrate the ability to work collaboratively in a team setting
- ➢ Demonstrate the ability to work and communicate effectively with people of different backgrounds and expertise in a group environment
- ➢ Demonstrate the ability to recognize expertise in others, and to learn from others

User Validation – *Foundation Learning Component*
- ➢ Demonstrate the ability to develop and implement an effective testing program that supports all phases of the development process

KEY COMPETENCIES

Key Competencies are specific, observable behaviors, knowledge, abilities and skills that detail and support the Program Outcomes.

Client Programming – *Technical Learning Component*

Learner Program Outcomes
- ➢ Demonstrate the ability to explain and apply the necessary phases of application development in a Client/Server environment, with emphasis on the client component

Key Competencies
Demonstrate the ability to:
- ➢ Define the constraints of the application architecture
- ➢ Define candidate solutions to business problem, and select best approach
- ➢ Detail the development process and methods best suited for the project
- ➢ Develop data, application and interface schema to meet business process requirements
- ➢ Develop and test prototypes
- ➢ Make recommendation for design changes based on prototyping test results
- ➢ Participate and conduct design and development reviews
- ➢ Document design and development, and changes in design according to company policies
- ➢ Construct database, application programs, and system and user interfaces for flexibility and adaptability
- ➢ Perform unit and system tests, and troubleshoot problems
- ➢ Follow organization standards for development
- ➢ Establish performance standards and quality checks
- ➢ Install and test integrated solution

Performance Indicators – Proficiency level
Demonstrate the ability to:
- ➢ Identify and define the general constraints of the application
- ➢ Explain how specific constraints impact the choice of design
- ➢ Develop candidate solutions for the application
- ➢ Present advantages and limitations of each candidate solution
- ➢ Select best approach for the application
- ➢ Select development methods and tools for project, and justify selection
- ➢ Detail development process to a level appropriate for documentation and communication with project members
- ➢ Develop database schema to meet project data requirements and constraints
- ➢ Develop application schema to meet process requirements and constraints
- ➢ Develop system interface schema based on system and component specifications
- ➢ Develop user interface schema to meet user need and application constraints
- ➢ Develop application prototypes
- ➢ Test application prototypes for functionality
- ➢ Analyze test results and make recommendations for design modification
- ➢ Actively participate in design reviews
- ➢ Develop and maintain clear and accurate documentation according to company policies
- ➢ Construct database objects based on database schema

➢ Develop application programs based on application schema
➢ Develop system interface based on system interface schema
➢ Develop user interface based on user interface schema
➢ Test unit and system for functionality
➢ Identify and resolve problems
➢ Assess system performance for usability against system specifications
➢ Install integrated solution and test against project requirements
➢ Develop test data bank

Performance Indicators – Expert level
Demonstrate the ability to:
➢ Organize and conduct design reviews
➢ Evaluate development and design for efficiency, flexibility and adaptability
➢ Make recommendations for improved efficiency in the design and development process
➢ Follow organization standards for design and development
➢ Establish performance standards and quality checks
➢ Measure performance against quality standards

Computer Applications – *Technical Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to use proficiently office software, including word processing, spreadsheet and Internet browser applications
➢ Demonstrate the ability to apply office software applications to solve business problems

Key Competencies
Demonstrate the ability to:
➢ Perform basic functions and configuration, and use available resources in a Windows environment
➢ Create simple word processing documents, such as letters and memos, with appropriate format
➢ Create compound word processing documents including drawings and objects from multiple software applications, such as embedded spreadsheets
➢ Create word processing documents with formats and styles meeting purpose and needs of intended audience
➢ Explain general spreadsheet design concepts and terminology
➢ Create and modify spreadsheets, and create associated charts and graphs
➢ Apply spreadsheet principles to solve business problems
➢ Import and export data between different applications
➢ Use browser applications to conduct effective searches on the Internet
➢ Use the main functions of e-mail systems
➢ Explain etiquette and proprietary issues when working with the Internet
➢ Perform simple configuration of office software to meet specific needs
➢ Use utility tools and perform basic troubleshooting of documents and spreadsheets

Performance Indicators – Proficiency level
Demonstrate the ability to:
➢ Perform basic functions, and use basic tools and accessories in a Windows environment
➢ Organize and manage files and folders in a Windows environment, including creating, deleting, moving, finding and copying
➢ Configure Windows and applications, and customize desktop to meet user preferences
➢ Start programs, create and open documents
➢ Share information between different applications
➢ Use online help in Windows and applications to locate relevant information
➢ Develop, edit, save, retrieve and print documents in various applications
➢ Use application utility tools to optimize document
➢ Use simple and advanced formatting word processing functions
➢ Work with columns and tables in a word processing document
➢ Embed objects form other applications into word processing and spreadsheet documents
➢ Explain general spreadsheet design concepts and terminology
➢ Design, create and modify spreadsheets

- ➢ Create, move and format ranges in a spreadsheet
- ➢ Create appropriate charts and graphs in a spreadsheet
- ➢ Use basic mathematical, logical and statistical functions in automating workbooks
- ➢ Create, edit and run macros to automate functions in a spreadsheet
- ➢ Import and export data, link multiple workbooks and use templates
- ➢ Apply spreadsheet principles to business problems
- ➢ Use basic browser functions
- ➢ Conduct effective searches on the Internet
- ➢ Use the basic functions of e-mail systems
- ➢ Organize and maintain Internet book mark lists and e-mail address books

Performance Indicators – Expert level
Demonstrate the ability to:
- ➢ Create documents with formats and styles meeting purpose and needs of intended audience
- ➢ Ability to troubleshoot complex spreadsheets
- ➢ Ability to analyze spreadsheet design for effectiveness
- ➢ Ability to create spreadsheets that effectively solve business problems
- ➢ Explain etiquette and proprietary issues when working with the Internet

Computer Systems History and Trends – *Technical Learning Component*

Learner Program Outcomes
- ➢ Demonstrate the ability to discuss the issues affecting the selection of a computer system for a specific environment
- ➢ Demonstrate the ability to present current computer technology and systems trends

Key Competencies
Demonstrate the ability to:
- ➢ Explain the purpose of gathering and managing information as an integral part of conducting business
- ➢ Explore the issues of privacy and right of access to information
- ➢ Explain the costs involved in installing or upgrading a computer system
- ➢ Conduct a simple cost/benefit analysis for different systems in different business environments
- ➢ Explain the evolution of computing system architectures
- ➢ Discuss the main trends in information technology
- ➢ Explain the main advantages and disadvantages of different system architectures
- ➢ Explain the concepts of technology patenting, copyrighting, and software licensing
- ➢ Explain the projected impact of the Internet on computer systems and applications

Performance Indicators – Proficiency level
Demonstrate the ability to:
- ➢ Explain the distinction between information and data
- ➢ Explain the meaning and scope of information technology
- ➢ Explain the functions and limitations of computers in general terms
- ➢ Explain the main impacts of information technology on society
- ➢ Explain the main impacts of information technology on communications
- ➢ Explain the main impacts of information technology on the workplace
- ➢ Explain the main impacts of information technology on the teaching and learning environment
- ➢ Describe the main impacts of the Internet and multimedia on society, education and business
- ➢ Explain the important phases in the development of computing systems and information technology
- ➢ Present the key contributors to the evolution of information technology
- ➢ Explain the purpose and evolution of programming languages
- ➢ Explain the main information system architectures
- ➢ Explain how information systems are used in different areas of business (customer service, inventory control, manufacturing and quality control, research and development, payroll, marketing,…)
- ➢ Present issues of copyrighting and licensing
- ➢ Discuss ethics issues as they relate to information technology

Performance Indicators – Expert level

Demonstrate the ability to:

> ➤ Discuss the trends in information technology hardware and software
> ➤ Discuss the trends in and impact of multimedia technology
> ➤ Discuss the trends in and impact of the use of the Internet in business and society
> ➤ Explain the key differences and tradeoffs between centralized and decentralized information systems
> ➤ Explore the cost and benefit issues involved in purchasing or upgrading a computer system
> ➤ Explain the impact on efficiency during the transition to a new information system
> ➤ Generate recommendations for the design of information systems for specific business needs and environments

Database Design – *Technical Learning Component*

Learner Program Outcomes
➢ Demonstrate ability to create & utilize relational databases, including modeling data, developing queries, customizing forms & reports, using code, creating charts and working with graphics
➢ Demonstrate the ability to explain the importance of databases and information as a commodity in this high-tech age

Key Competencies
Demonstrate the ability to:
➢ Explain database design concepts and the role of database components
➢ Model data and design database structure
➢ Design, Create and utilize relational databases
➢ Create and edit tables, develop complex queries and create reports
➢ Create and customize forms and reports
➢ Create graphs and add pictures to database elements
➢ Use intrinsic programming language
➢ Explain the use of databases and information in the business environment
➢ Develop database business applications that meet the needs of the client
➢ Explain database normalization and normalize database tables
➢ Use object oriented development environment
➢ Use joins to link appropriate tables in query

Performance Indicators – Proficiency level
Demonstrate the ability to:
➢ Explain the use of information and databases in the business environment
➢ Design simple databases
➢ Explain the relationships between database components
➢ Open a database, create tables and modify table design
➢ Create and modify simple forms
➢ Create and modify controls in a form
➢ Enhance form design
➢ Create and use sub forms
➢ Modify field properties and layout
➢ Sort data on single and multiple fields
➢ Create and modify simple queries
➢ Create a query with multiple criteria
➢ Add and remove filters
➢ Add and remove fields to a query
➢ Explain the different types of queries and their purpose
➢ Build summary queries and set cross-tab queries
➢ Create, modify and customize reports
➢ Group and sort data in reports
➢ Make calculations in reports
➢ Explain database normalization
➢ Normalize database tables
➢ Join tables in a query using inner and outer joins

Performance Indicators – Expert level

Demonstrate the ability to:

- ➢ Import and link data
- ➢ Add pictures to a record
- ➢ Set validation rules
- ➢ Appropriately use intrinsic programming language
- ➢ Explain and use the characteristics of object oriented development environment
- ➢ Create databases that solve business problems
- ➢ Analyze database design for functionality and efficiency

Math and Science for Programmers – *Technical Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to explain and apply basic mathematical processes as they relate to programming; including statistics, logic, relational algebra, number systems, and cost/benefit analysis
➢ Demonstrate the ability to explain and apply basic science processes as they relate to programming; including design of experimentation, data gathering and analysis, sensor performances

Key Competencies
Demonstrate the ability to:
➢ Explain the principles and methods of basic statistical analysis, and apply to the design and analysis of test and survey scenarios
➢ Explain the principles of logic and apply to the development of programming structures
➢ Solve algebraic equations and correctly use algebraic functions in solving problems
➢ Explain the basic principles of number systems and convert between different number systems
➢ Explain the principles and methods of cost/benefit analysis, and apply to decision making in the context of system analysis
➢ Explain the principles of experimentation design and apply to data gathering projects
➢ Explain the principles and methods of data gathering and analysis, and relate to the reliability of experimental data
➢ Develop sensor based acquisition systems and present the associated limitations in data accuracy

Performance Indicators – Proficiency level
Demonstrate the ability to:
➢ Explain the basic principles and methods of statistical analysis
➢ Design survey processes and select sample population based on statistical principles
➢ Analyze survey results using appropriate statistical tools
➢ Explain and use the basic principles of logic
➢ Apply logic to the development of programming structures
➢ Identify logic inconsistencies in a programming flow chart
➢ Apply and solve algebraic functions
➢ Set up the appropriate algebraic equations to solve a specific problem
➢ Convert between different number systems
➢ Explain the impact of rounding on computation accuracy
➢ Explain and apply the basic principles of cost/benefit analysis
➢ Develop cost/benefit data for different solutions to a problem
➢ Analyze cost/benefit data and use to select best approach to problem
➢ Explain and apply the principles and methods of experimental design
➢ Design experiments for data gathering projects
➢ Explain and justify assumptions in data gathering experiments
➢ Analyze results in light of experimental design and limitations

Performance Indicators – Expert level

Demonstrate the ability to:

➢ Explain and quantify the impact of error, uncertainty and accuracy on experimental and process results
➢ Develop sensor based acquisition systems
➢ Explain and justify the associated limitation in specific sensor based systems
➢ Analyze mathematical process for efficiency and elegance
➢ Explain how mathematical principles and processes apply and support program development and testing

Network Architectures and Systems – *Technical Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to explain the design characteristics and components of network systems
➢ Demonstrate the ability to design and implement simple network architectures
➢ Demonstrate the ability to perform basic network hardware and software installation and configuration procedures, and troubleshoot basic network problems

Key Competencies
Demonstrate the ability to:
    ➢ Present the functions and design principles of network systems
    ➢ Describe and explain purpose of network components
    ➢ Describe and explain different network configurations and protocols
    ➢ Present and discuss the processes of network administration
    ➢ Present and discuss the issues of and strategies for network security
    ➢ Design network systems for a wide range of environments
    ➢ Perform basic installation/configuration of network components and software
    ➢ Troubleshoot basic problems with software and hardware installation/configuration

Performance Indicators – Proficiency level
Demonstrate the ability to:
    ➢ Present the functions of a network
    ➢ Present network system design principles
    ➢ Name network components
    ➢ Explain the purpose of network components
    ➢ Describe and compare different network topologies
    ➢ Describe and compare different network protocols
    ➢ Describe the processes of network administration
    ➢ Describe basic network security procedures
    ➢ Design different network configurations
    ➢ Install a network server
    ➢ Configure a network server
    ➢ Install and configure network cards and peripherals
    ➢ Connect and configure workstations to the network
    ➢ Install network operating system
    ➢ Install application software on network
    ➢ Troubleshoot simple network problems
    ➢ Configure operating system for networking environment

Performance Indicators – Expert level
Demonstrate the ability to:
    ➢ Troubleshoot a wide range of network problems at the server and the workstation level
    ➢ Recommend a network design given a specific context and set of user needs
    ➢ Perform network system upgrades and migrations
    ➢ Fine-tune the performance of the network.

Network Operating Systems – *Technical Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to explain the characteristics of different network operating systems
➢ Demonstrate the ability to install, use, configure and troubleshoot most commonly used network operating systems

Key Competencies
Demonstrate the ability to:
➢ Explain the characteristics and the limitations of different network operating systems
➢ Select an operating systems for a specific networking environment
➢ Install and configure most commonly used network operating systems
➢ Perform basic troubleshooting on network operating systems
➢ Configure Windows 95 for networking environments
➢ Explain the basic concepts and design principles of Windows NT
➢ Operate in a Windows NT environment and work with Windows NT applications
➢ Configure Windows NT server and workstations in an enterprise networking environment

Performance Indicators – Proficiency level
Demonstrate the ability to:
➢ Present current trends in network operating systems
➢ Present the characteristics of different network operating systems
➢ Present the limitations of different network operating systems
➢ Configure Windows 95 for networking environment
➢ Explain the basic concepts of Windows NT
➢ Present the basic design principles of Windows NT
➢ Install Windows NT operating system
➢ Configure Windows NT operating system to meet systems specification and user needs
➢ Optimize Windows NT operating system for networking environment
➢ Troubleshoot basic problems in a Windows NT operating system
➢ Perform backup operations on Windows NT network systems

Performance Indicators – Expert level
Demonstrate the ability to:
➢ Select an operating system for a specific networking environment and to meet specific business requirements
➢ Identify and resolve a wide range of problems in a Windows NT environment
➢ Optimize Windows NT configuration in an enterprise networking environment

Principles of Accounting – *Technical Learning Component*

Learner Program Outcomes
- ➢ Demonstrate the ability to explain and apply basic accounting principles
- ➢ Demonstrate the ability to explain how computer applications support the financial workings of a business organization

Key Competencies
Demonstrate the ability to:
- ➢ Define and use appropriately basic accounting terminology
- ➢ Record business transactions using recognized accounting principles
- ➢ Explain and apply the principles of payroll accounting
- ➢ Present the basic advantages and disadvantages of sole proprietorship, partnership and corporation from a financial perspective
- ➢ Develop and analyze income statements, statements of capital and balance sheets
- ➢ Make general recommendations based on financial statements
- ➢ Develop models to represent financial administration systems
- ➢ Use software tools to record financial transactions in a business environment
- ➢ Use software tools to analyze the financial health of an organization
- ➢ Explain how the different units of a business interact with the financial department
- ➢ Discuss the forces and economic conditions that exist in operating a business

Performance Indicators – Proficiency level
Demonstrate the ability to:
- ➢ Define basic accounting principles
- ➢ Define and use appropriately accounting terminology
- ➢ Explain the characteristics of different accounting systems
- ➢ Record business transactions using appropriate accounting systems
- ➢ Explain the principles of payroll accounting
- ➢ Apply the principles of payroll accounting in a business context
- ➢ Present the characteristics and limitations of different types of business entities
- ➢ Explain how the accounting process is affected by the type of business entity
- ➢ Develop simple income statements, statements of capital and balance sheets
- ➢ Analyze income statements, statements of capital and balance sheets
- ➢ Describe available financial software tools
- ➢ Use most common financial software tools at a basic level of expertise

Performance Indicators – Expert level
Demonstrate the ability to:
- ➢ Make general business strategy recommendations based on financial statements
- ➢ Develop and exercise models to represent financial administration systems
- ➢ Analyze the financial health of an organization using software tools
- ➢ Explain how the operational organization of a business impacts its financial organization
- ➢ Explain how the different units interact with the finance department
- ➢ Discuss the forces and economic conditions that impact the operation of a business
- ➢ Present the differences from a financial perspective between for-profit and non-profit organizations

Programming Language – C – *Technical Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to write, compile, debug and execute well engineered and maintainable C programs that effectively meet the application requirements

Key Competencies
Demonstrate the ability to:
➢ Explain and apply the basic concepts of programming
➢ Present the elements and features of the C programming environment
➢ Explain and effectively use the C design process and structure
➢ Define and appropriately use pointers, data types, arrays and data strings
➢ Define and appropriately use decision and repetition structures
➢ Define and appropriately use functions, recursion and storage classes
➢ Use appropriately C operators and functions
➢ Define and appropriately use dynamic data structures
➢ Define and explain trends in C standards
➢ Write, compile, debug and execute programs in C
➢ Present the advantages and limitations of programming in C
➢ Troubleshoot C programs
➢ Build well engineered and maintainable C programs to meet business applications

Performance Indicators – Proficiency level
Demonstrate the ability to:
➢ Explain the basic concepts of programming in C
➢ Apply the basic C programming concepts when developing program
➢ Present the elements of C programming
➢ Explain and apply the C design process
➢ Explain and apply the C design structure
➢ Define and appropriately use pointers
➢ Define and appropriately use data types
➢ Define and appropriately use arrays
➢ Define and appropriately use data strings
➢ Define and appropriately use decision structures
➢ Define and appropriately use repetition structures
➢ Define and appropriately use recursion
➢ Define and appropriately use storage classes
➢ Appropriately use C operators and functions
➢ Define and appropriately use dynamic data structures
➢ Write C programs
➢ Compile C programs
➢ Debug C programs
➢ Execute C programs
➢ Troubleshoot C programs
➢ Document program design, development and testing

Performance Indicators – Expert level
Demonstrate the ability to:
  ➢ Define and explain trends in C standards
  ➢ Present the advantages and limitations of C programming
  ➢ Build well engineered and maintainable C programs to meet business applications

Programming Language – C++ – *Technical Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to write, compile, debug and execute well engineered and maintainable C++ programs that effectively meet the application requirements

Key Competencies
Demonstrate the ability to:
➢ Explain and apply the basic concepts of programming
➢ Present the elements and features of the C++ programming environment
➢ Present the characteristics of object oriented programming
➢ Explain and effectively use the C++ design process and structure
➢ Use appropriately C++ operators and functions
➢ Define and appropriately use pointers, data types, variables and arrays
➢ Define and appropriately use constructor and destructor functions, and perform dynamic memory allocation
➢ Define and appropriately use operator overloading
➢ Define and appropriately use decision and repetition structures
➢ Define and appropriately use inheritance mechanisms in C++ programming
➢ Define and explain trends in C++ standards
➢ Write, compile, debug and execute programs in C++
➢ Present the advantages and limitations of programming in C++
➢ Troubleshoot C++ programs
➢ Build well engineered and maintainable C++ programs to meet business applications

Performance Indicators – Proficiency level
Demonstrate the ability to:
➢ Explain the basic concepts of programming in C++
➢ Apply the basic C++ programming concepts when developing program
➢ Present the elements of C++ programming
➢ Describe the characteristics of object oriented programming
➢ Explain and apply the C++ design process
➢ Explain and apply the C++ design structure
➢ Define and appropriately use pointers
➢ Define and appropriately use data types
➢ Define and appropriately use arrays
➢ Define and appropriately use variables
➢ Define and appropriately use constructor functions
➢ Define and appropriately use destructor functions
➢ Define and appropriately use decision structures
➢ Define and appropriately use repetition structures
➢ Perform dynamic memory allocation
➢ Define and appropriately use operator overloading
➢ Appropriately use C++ operators and functions
➢ Define and appropriately use inheritance mechanisms
➢ Write C++ programs

➢ Compile C++ programs
➢ Debug C++ programs
➢ Execute C++ programs
➢ Troubleshoot C++ programs
➢ Document program design, development and testing

Performance Indicators – Expert level
Demonstrate the ability to:
➢ Define and explain trends in C++ standards
➢ Present the advantages and limitations of C++ programming
➢ Build well engineered and maintainable C++ programs to meet business applications

Programming Language – SQL – *Technical Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to explain and apply the principles of SQL programming

Key Competencies
Demonstrate the ability to:
  ➢ Explain the purpose and use of Structured Query Language
  ➢ Define and appropriately use SQL statements and logical operators
  ➢ Perform data retrieval and relational joins using SQL
  ➢ Perform data modification, including adding, updating and deleting rows
  ➢ Define and appropriately use aliases and subqueries
  ➢ Effectively manage and use views
  ➢ Create and use indexes, triggers and cursors
  ➢ Define effectively rules and defaults, and user restriction
  ➢ Explain general administration responsibilities of a Database Administrator
  ➢ Define and appropriately use joins
  ➢ Create stored procedures with input and output parameters, and return values
  ➢ Effectively manage user permissions

Performance Indicators – Proficiency level
Demonstrate the ability to:
  ➢ Explain the purpose of SQL
  ➢ Define and appropriately use SQL statements
  ➢ Define and appropriately use SQL logical operators
  ➢ Perform data retrieval using SQL statements
  ➢ Perform relational joins using SQL
  ➢ Add, delete and update data using SQL statements
  ➢ Define and appropriately use SQL aliases
  ➢ Define and appropriately use SQL subqueries
  ➢ Manage and use views
  ➢ Create and use indexes
  ➢ Create and use triggers
  ➢ Create and use cursors
  ➢ Define effectively rules and defaults
  ➢ Define effectively user permissions
  ➢ Define and appropriately use joins

Performance Indicators – Expert level
Demonstrate the ability to:
  ➢ Explain general administration responsibilities of a Database Administrator
  ➢ Create stored procedures with input and output parameters, and return values

Programming Language – Visual Basic – *Technical Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to write, compile, debug and execute well engineered and maintainable Visual Basic programs that effectively meet the application requirements

Key Competencies
Demonstrate the ability to:
  ➢ Explain and apply the basic concepts of programming
  ➢ Present the elements and features of the Visual Basic programming environment
  ➢ Present the characteristics of object oriented programming
  ➢ Explain and effectively use the Visual Basic design process
  ➢ Define and appropriately use the standard, advanced and graphic Visual Basic controls
  ➢ Define and appropriately use the Visual Basic data types, variables and procedures
  ➢ Define and appropriately use decision and repetition structures
  ➢ Define and appropriately use the Visual Basic menus and dialog boxes
  ➢ Define and appropriately use the Visual Basic data access methods
  ➢ Write, compile, debug and execute programs in Visual Basic
  ➢ Present the advantages and limitations of programming in Visual Basic
  ➢ Troubleshoot Visual Basic programs
  ➢ Build well engineered and maintainable Visual Basic programs to meet business applications
  ➢ Define and develop appropriate class modules
  ➢ Develop and appropriately use code components
  ➢ Integrate visual basic programs into Web applications

Performance Indicators – Proficiency level
Demonstrate the ability to:
  ➢ Explain the basic concepts of programming in Visual Basic
  ➢ Apply the basic Visual Basic programming concepts when developing program
  ➢ Present the elements of Visual Basic programming
  ➢ Explain and apply the Visual Basic design process
  ➢ Describe the characteristics of object oriented programming
  ➢ Define and appropriately use standard Visual Basic controls
  ➢ Define and appropriately use advanced Visual Basic controls
  ➢ Define and appropriately use graphic Visual Basic controls
  ➢ Define and appropriately use data types
  ➢ Define and appropriately use variables
  ➢ Define and appropriately use procedures
  ➢ Define and appropriately use decision structures
  ➢ Define and appropriately use repetition structures
  ➢ Define and appropriately use menus
  ➢ Define and appropriately use dialog boxes
  ➢ Define and appropriately use data access methods
  ➢ Write Visual Basic programs

> ➢ Compile Visual Basic programs
> ➢ Debug Visual Basic programs
> ➢ Execute Visual Basic programs
> ➢ Troubleshoot Visual Basic programs
> ➢ Document program design, development and testing.

Performance Indicators – Expert level
Demonstrate the ability to:

> ➢ Create and appropriately code components (in-process and out-of-process)
> ➢ Define and explain trends in Visual Basic standards
> ➢ Present the advantages and limitations of Visual Basic programming
> ➢ Build well engineered and maintainable Visual Basic programs to meet business applications
> ➢ Develop and integrate Visual Basic programs into Web applications

Quality Assurance – *Technical Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to explain and apply quality assurance processes as they relate to programming
➢ Demonstrate the ability to Discuss quality issues in a technology organization

Key Competencies
Demonstrate the ability to:
➢ Discuss quality processes, issues, challenges and trends in today's business environment
➢ Present the critical elements of design and development for quality
➢ Establish processes and check points to monitor quality through all phases of the development process
➢ Adhere to quality policies and procedures
➢ Analyze models, description and prototypes for consistency, completeness and conformance to accepted rules of methodology
➢ Discuss how communication is an intrinsic part of quality
➢ Identify quality problems and propose solutions
➢ Continuously review processes and tools to improve product quality

Performance Indicators – Proficiency level
Demonstrate the ability to:
➢ Define quality as it applies to systems analysis and design
➢ Present the different issues and challenges that affect quality of design, testing and implementation
➢ Discuss the trends in quality assurance as it relates to programming
➢ Present the critical elements of design and development for quality
➢ Develop quality monitoring systems
➢ Apply quality check points throughout the development process
➢ Explain and apply quality policies and procedures
➢ Discuss how communication impacts quality of process and product
➢ Propose communication scenarios to improve quality of process and product
➢ Identify quality problems as they arise
➢ Propose realistic and effective solutions to identified problems

Performance Indicators – Expert level
Demonstrate the ability to:
➢ Analyze the effectiveness of different quality assurance systems
➢ Make recommendations for quality assurance improvement
➢ Continuously monitor quality throughout the design, development, testing and implementation phases
➢ Analyze models, description and prototypes for consistency, completeness and conformance to accepted rules of methodology

Server Programming – *Technical Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to explain and apply the necessary phases of application development in a Client/Server environment, with emphasis on the server component

Key Competencies
Demonstrate the ability to:
➢ Define the constraints of the network architecture
➢ Define candidate solutions, and select best approach
➢ Detail the development process and methods best suited for the project
➢ Develop data, network and interface schema to meet business process requirements
➢ Develop and test prototypes
➢ Make recommendation for design changes based on prototyping test results
➢ Participate and conduct design and development reviews
➢ Document design and development, and changes in design according to company policies
➢ Construct database, network programs and system interfaces for flexibility and adaptability
➢ Perform unit and system tests, and troubleshoot problems
➢ Follow organization standards for development
➢ Establish performance standards and quality checks
➢ Install and test integrated solution

Performance Indicators – Proficiency level
Demonstrate the ability to:
➢ Identify and define the general constraints of the network
➢ Explain how specific constraints impact the choice of solution design
➢ Develop candidate solutions for the system
➢ Present advantages and limitations of each candidate solution
➢ Select best approach for the system
➢ Select development methods and tools for project, and justify selection
➢ Detail development process to a level appropriate for documentation and communication with project members
➢ Develop database schema to meet project requirements and constraints
➢ Develop network schema to meet process requirements and constraints
➢ Develop system interface schema based on system and component specifications
➢ Develop system prototypes
➢ Test system prototypes for functionality
➢ Analyze test results and make recommendations for design modification
➢ Actively participate in design reviews
➢ Develop and maintain clear and accurate documentation according to company policies
➢ Construct database objects based on database schema
➢ Develop programs based on network schema
➢ Develop system interface based on system interface schema

- ➢ Test unit and system for functionality
- ➢ Identify and resolve problems
- ➢ Assess system performance against system specifications
- ➢ Install integrated solution and test against project requirements

Performance Indicators – Expert level

Demonstrate the ability to:
- ➢ Organize and conduct design reviews
- ➢ Evaluate development and design for efficiency, flexibility and adaptability
- ➢ Make recommendations for improved efficiency in the design and development process
- ➢ Follow organization standards for design and development
- ➢ Establish performance standards and quality checks
- ➢ Measure performance against quality standards

Systems Analysis – *Technical Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to explain and apply the necessary processes, tools and skills used in the systems analysis phase of a project

Key Competencies
Demonstrate the ability to:
➢ Gather data to identify client requirements, resources and risks
➢ Interpret and evaluate requirements for completeness, relevance, accuracy and consistency
➢ Identify and resolve conflicting requirements
➢ Identify time, technology and resource constraints
➢ Resolve conflicts between requirements and constraints, and negotiate resolution with client
➢ Develop high level systems and functional specifications
➢ Perform data flow, event analysis and object modeling
➢ Develop concepts including alternatives and prepare a cost/benefit estimate for each option
➢ Identify risks and their impact on the overall project
➢ Define general scope of work to meet requirements and constraints
➢ Establish measurable performance requirements
➢ Develop business process and logical data model

Performance Indicators – Proficiency level
Demonstrate the ability to:
➢ Identify relevant sources of information
➢ Recognize the clients for the project
➢ Gather data and extract relevant information
➢ Analyze and synthesize the information
➢ Identify missing information and find sources to complete requirement set
➢ Identify conflicting information
➢ Validate information for accuracy and completeness
➢ Identify time, technology and resource constraints
➢ Resolve conflicts between requirements and constraints
➢ Validate requirement set with clients
➢ Develop concepts
➢ Develop alternatives with benefit analysis
➢ Develop general scope of work
➢ Summarize, communicate and document information in a proposal outline
➢ Construct complex data models

Performance Indicators – Expert level
Demonstrate the ability to:
➢ Identify potential risks and their impact on overall project
➢ Prepare a cost/benefit estimate for each alternative and make recommendations

> ➢ Determine need for further analysis and make recommendations
> ➢ Develop feedback strategies to monitor the process of analysis
> ➢ Evaluate the process of analysis and its effectiveness, and make recommendations for improvement
> ➢ Develop detailed proposal including recommendations, alternatives, risks, cost/benefit summary and scope of proposed work
> ➢ Perform Use Case and other object based modeling techniques

Systems Design – *Technical Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to explain and apply the necessary processes, tools and skills used in the systems design phase of a project

Key Competencies
Demonstrate the ability to:
- ➢ Specify major subsystems and interfaces
- ➢ Develop detail design specifications
- ➢ Select design methodology and tools
- ➢ Identify maintenance requirements
- ➢ Perform feasibility studies of design alternatives
- ➢ Identify physical requirements for systems implementation
- ➢ Prepare and conduct design reviews
- ➢ Identify impact on existing systems
- ➢ Perform usability testing and human factor analysis
- ➢ Develop test plan
- ➢ Establish security requirements

Performance Indicators – Proficiency level
Demonstrate the ability to:
- ➢ Identify major subsystems
- ➢ Identify major system interfaces
- ➢ Develop detailed specifications for subsystems
- ➢ Develop detailed specifications for system interfaces
- ➢ Identify requirements for system implementation
- ➢ Identify security requirements
- ➢ Identify impact on existing systems
- ➢ Select design methodology to meet application requirements and project constraints
- ➢ Select design tools to meet the application requirements and project constraints
- ➢ Develop business process model
- ➢ Develop logical data model
- ➢ Identify maintenance requirements for system
- ➢ Develop design alternatives
- ➢ Select best design for project
- ➢ Actively participate in design reviews
- ➢ Develop test plan and test data bank
- ➢ Implement test plan
- ➢ Perform usability testing
- ➢ Analyze test results and make recommendation for design changes

Performance Indicators – Expert level
Demonstrate the ability to:
- ➢ Organize and conduct design reviews
- ➢ Explain and apply the principles of iterative design process
- ➢ Analyze the effectiveness of the design methodology and make recommendations for improvement

Technical Documentation – *Technical Learning Component*

Learner Program Outcomes
- Demonstrate the ability to select and use technical documentation formats meeting the intended purpose and the guidelines of the organization
- Demonstrate the ability to develop effective and accurate technical documentation appropriate to various audiences and purposes

Key Competencies
Demonstrate the ability to:
- Write in a concise and precise form appropriate for technical documentation
- Explain and use the processes and techniques of technical documentation
- Record system specifications accurately and completely
- Prepare materials written to convey specific technical problems, related issues, and solutions
- Explain the purpose of logs, reports, training manuals and other forms of technical documentation
- Adhere to documentation industry and organization guidelines and standards
- Document design changes as they are adopted
- Create and update documentation through all phases of the systems life cycle
- Accurately document strengths and weaknesses of the system
- Effectively organize the data in the systems repository
- Effectively track multiple versions of a system documentation
- Use Case tools to assist in system documentation

Performance Indicators – Proficiency level
Demonstrate the ability to:
- Explain the purpose of technical documentation
- Explain the purpose of different forms of technical documentation
- Write in a concise and precise form
- Adapt technical documentation to the requirements of the project and the organization
- Record system specifications accurately and completely
- Follow organization and industry technical documentation standards
- Document technical problems and causes
- Document solutions to problems
- Document design changes using proper documentation process
- Update documentation on a timely basis
- Develop documentation that is accurate and complete
- Accurately document system strengths and weaknesses
- Use Case tools to maintain version control and document system requirements

Performance Indicators – Expert level
Demonstrate the ability to:
- Evaluate effectiveness of different technical documentation processes
- Effectively organize the data in the systems repository
- Analyze the organization of the system repository for effectiveness and usability
- Effectively track multiple versions of a system documentation.

Testing and De-bugging – *Technical Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to apply debugging and testing tools and techniques
➢ Demonstrate the ability to develop and apply systematic debugging and testing processes

Key Competencies
Demonstrate the ability to:
➢ Select debugging and testing methodology, and develop comprehensive and systematic test plan
➢ Design testing programs to uncover hardware compatibility problems during the development phase of the project
➢ Select program debugging tools and techniques
➢ Develop testing procedures
➢ Conduct tests in the most efficient way
➢ Test programs, and document errors and solutions
➢ Select testing tools and develop test system
➢ Perform system integration testing
➢ Perform volume/performance testing
➢ Analyze and document test results following policies and procedures
➢ Summarize test results and make appropriate recommendations
➢ Implement changes based on test results, and communicate results and recommendations to appropriate team members and clients
➢ Evaluate the effectiveness of the testing plan and procedures on a continuous basis
➢ Assess overall product effectiveness and performances, and perform summative evaluation

Performance Indicators – Proficiency level
Demonstrate the ability to:
➢ Present the purpose of testing
➢ Present available tools in debugging and testing
➢ Present different testing principles and processes
➢ Select appropriate debugging tools for the specific application
➢ Select appropriate testing methodology for the specific application
➢ Design various testing programs for the different phases of the project
➢ Develop sets of testing procedures
➢ Conduct tests in the most efficient way
➢ Debug programs
➢ Perform system integration testing
➢ Test system for functionality and usability
➢ Perform volume/performance testing
➢ Identify problems and develop solutions
➢ Document debugging and testing processes, results and solutions to problems following policies and procedures
➢ Analyze test results and identify sources of problems
➢ Summarize test results and make recommendations
➢ Implement changes based on test results

Performance Indicators – Expert level
Demonstrate the ability to:
- ➢ Explain the cost constraints and benefits of testing programs
- ➢ Select testing plan based on project requirements and constraints
- ➢ Communicate critical test phases and results to project team members and clients
- ➢ Evaluate the effectiveness of the testing plan and procedures on a continuous basis
- ➢ Assess overall product effectiveness and performances, and perform summative evaluation
- ➢ Construct test data bank

User Interface Design – *Technical Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to explain and apply the necessary processes, tools and skills used in effective user interface design

Key Competencies
Demonstrate the ability to:
- ➢ Define the requirements for the user interface
- ➢ Define candidate solutions to business problem, and select best approach with client
- ➢ Detail the development process and methods best suited for the project
- ➢ Develop user interface schema to meet user requirements
- ➢ Develop and test prototypes
- ➢ Make recommendation for design changes based on prototyping test results
- ➢ Participate and conduct design and development reviews
- ➢ Document design and development, and changes in design according to company policies
- ➢ Construct user interfaces for flexibility and adaptability
- ➢ Perform user interface tests, and troubleshoot problems
- ➢ Follow organization and industry standards for development
- ➢ Establish performance standards and quality checks
- ➢ Train system user on interface and perform user validation

Performance Indicators – Proficiency level
Demonstrate the ability to:
- ➢ Identify and define the general constraints of the user interface
- ➢ Explain how specific constraints impact the choice of design
- ➢ Develop candidate solutions for the user interface
- ➢ Present advantages and limitations of each candidate solution
- ➢ Select best approach for the user interface design
- ➢ Select development methods and tools for project, and justify selection
- ➢ Detail development process to a level appropriate for documentation and communication with project members
- ➢ Develop user interface schema to meet user need and application constraints
- ➢ Develop user interface prototypes
- ➢ Test user interface prototypes for functionality and usability
- ➢ Analyze test results and make recommendations for design modification
- ➢ Actively participate in design reviews
- ➢ Develop and maintain clear and accurate documentation according to company policies
- ➢ Construct user interface based on user interface schema
- ➢ Test user interface for functionality and usability
- ➢ Identify and resolve problems
- ➢ Assess user interface against specifications
- ➢ Follow quality insurance procedures
- ➢ Perform user validation

Performance Indicators – Expert level

Demonstrate the ability to:

➢ Organize and conduct design reviews
➢ Evaluate development and design for efficiency, flexibility and adaptability
➢ Make recommendations for improved efficiency in the design and development process
➢ Follow organization standards for design and development
➢ Establish performance standards and quality checks
➢ Measure performance against quality standards
➢ Develop and implement user training

Business Communication – *Foundation Learning Component*

Learner Program Outcomes
- Demonstrate the ability to select and exercise the appropriate communication vehicle for a specific purpose in a professional context
- Demonstrate the ability to communicate effectively in technical and business environments

Key Competencies
Demonstrate the ability to:
- Explain the purpose and different uses of communication in business and industry
- Identify the appropriate communication format for a specific purpose and situation
- Communicate effectively using a wide range of communication formats
- Use clear, focused, specific, and grammatically correct language and terminology
- Act in a courteous and professional manner when communicating with others using a degree of formality appropriate to the situation
- Analyze communication to effectively extract content and underlying issues
- Communicate effectively with audiences of various degrees of expertise in a wide range of technical and business contexts
- Balance visual and verbal elements, and text in written communication and presentations
- Act responsively to audience, and adjust communication format and content accordingly
- Prepare oral presentations that accurately convey specific technical information and that are appropriate for various audiences

Performance Indicators – Proficiency level
Demonstrate the ability to:
- Give examples of different uses of communication in business and industry
- Identify the appropriate communication process for a specific purpose
- Exercise effectively a wide range of communication process
- Listen and paraphrase effectively to enhance communication process
- Ask relevant and clarifying questions
- Act in a professional and courteous manner
- Use degree of formality appropriate to the situation
- Sustain a definite focus and point of view, and link ideas in a progressive, flowing sequence
- Use clear and grammatically correct language
- Use precise and accurate technical terminology
- Recognize and appropriately respond to audience focus, level of expertise and need for detail
- Compose and present well organized presentations
- Use various presentation technologies

Performance Indicators – Expert level

Demonstrate the ability to:

➢ Evaluate effectiveness of communication on a continuous basis by observing the audience and asking for feedback
➢ Adapt style and content of presentation to audience need and feedback
➢ Present information persuasively and sustain an argument using appropriate evidence or examples
➢ Perceive and explain underlying issues in the communication
➢ Effectively address and resolve conflict in communication
➢ Prepare and deliver professional presentations that are appropriate to purpose and intended audience
➢ Prepare communication pieces for audiences with various levels of technical expertise

Business Organization and Environment – *Foundation Learning Component*

Learner Program Outcomes
- Demonstrate the ability to discuss contemporary business principles, practices and organization, and a foundation of business terminology
- Demonstrate the ability to discuss how computer systems impact the operation and management of business and society

Key Competencies
Demonstrate the ability to:
- Explain contemporary business concepts, principles and practices, and the legal and social aspects of the business environment
- Explain the internal and external forces and economic conditions that affect the operation of a business
- Explain different business organizations, their respective advantages and disadvantages, and how they operate
- Explain the purpose of functional business areas including marketing, finance, accounting, research and development, manufacturing and management, and their relationships to one another
- Explain and use appropriately general business terminology
- Explain how and where computers are used in today's business, and discuss the impact of information systems on business operations
- Discuss the issues of privacy and confidentiality in the context of the use of computer systems and the Internet in the business environment
- Present the positive and negative impacts of computer technology on business and society, and discuss ethical issues in respect to the information age

Performance Indicators – Proficiency level
Demonstrate the ability to:
- Present general business economic issues and principles
- Discuss the social responsibility of business and business ethics
- Discuss the main differences between small and mid-to-large size businesses
- Discuss the issues particular to international corporations
- Discuss the concepts and issues of business management
- Discuss the concepts and issues of human resource management
- Describe the different functional groups that form the structure of organizations
- Use appropriate business terminology
- Discuss the role and interactions between different functional groups
- Explain the concepts and issues of marketing products and services
- Explain the basics of promotion and distribution
- Explain the uses of computers in business
- Describe how computer systems are used in different parts of a business organization
- Describe the impact of computers on access to information and information exchange worldwide
- Present ethical issues as they relate to the use of computers & information in today's society
- Define information privacy and describe how it has been and is currently affected by computers

Performance Indicators – Expert level
Demonstrate the ability to:
- ➢ Develop the outline of a business plan
- ➢ Analyze and present the differences between domestic and international organizations
- ➢ Analyze and present the impact marketing and distribution strategies have on the overall organization
- ➢ Explain the basic components of a financial statement
- ➢ Present the impact of organizational structure on the culture of the business
- ➢ Present the main concepts and issues of total quality management
- ➢ Develop recommendations for ethical codes of conduct for computer usage
- ➢ Describe how business needs for information have impacted technological development and society
- ➢ Discuss how information systems may change in the following areas: equipment, software, data, users, information systems, personnel, privacy and ethics

Client Relations – *Foundation Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to effectively listen and ask critical questions to identify clients issues and concerns
➢ Demonstrate the ability to resolve clients issues and concerns in a timely and appropriate manner

Key Competencies
Demonstrate the ability to:
> ➢ Explain the importance of clients in business, and the responsibilities of the business to its clients
> ➢ Identify client interactions and dynamics within and outside the organization
> ➢ Listen to the clients input and ask critical questions to differentiate between the actual needs and desires
> ➢ Communicate product cost/benefit compromises and effectively negotiate with clients to arrive at a best-fit solution
> ➢ Communicate project plan, status, risks and contingencies to clients in a timely manner and in an appropriate level of detail
> ➢ Solicit feedback from clients and apply input to improve the quality of service
> ➢ Schedule and manage effectively multiple clients' requests
> ➢ Recognize the client's level of experience and expertise, and tailor training and communication accordingly
> ➢ Deliver solution to clients in a timely and appropriate manner
> ➢ Act as a liaison between technical groups and users to coordinate delivery of service or product
> ➢ Recognize proprietary information and respect clients' confidentiality

Performance Indicators – Proficiency level
Demonstrate the ability to:
> ➢ Explain the role of customer service personnel in an organization
> ➢ Identify customer groups in various types of organization
> ➢ Explain the responsibilities of business towards customers and need for customer involvement
> ➢ Apply effective listening skills
> ➢ Ask questions that solicit productive input and feedback from customers
> ➢ Apply basic negotiation skills
> ➢ Respond effectively to customers needs and concerns
> ➢ Communicate alternatives and options
> ➢ Communicate in a timely manner with customers at all phases of the interaction
> ➢ Work effectively with multiple requests from a customer, and with multiple customers
> ➢ Deliver solutions that meet customer's needs in a timely and appropriate manner
> ➢ Tailor the complexity and amount of information delivered to the needs and expertise of the customers

Performance Indicators – Expert level
Demonstrate the ability to:
- Help customer prioritize "must have" versus "nice to have" features
- Act as a liaison between various technical groups
- Assess the effectiveness of the customer interaction process
- Make recommendations for improvement in the customer relation process
- Design training that meets the customers needs
- Follow-up with customers to evaluate the effectiveness of product over a period of time
- Recognize when a customer concern needs to be referred to someone else in or outside the organization
- Report and communicate recommendations to other parts of the organization on product or service design improvement based on customers inputs

Problem Solving – *Foundation Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to identify and use a wide range of techniques and tools to identify and solve technical problems
➢ Demonstrate the ability to use appropriate communication techniques to correctly isolate and identify a wide range of problems, and communicate resolution plans and/or solutions

Key Competencies
Demonstrate the ability to:
   ➢ Recognize a wide range of problems, and assess their impact on the system
   ➢ Use a wide range of troubleshooting methods and tools to isolate problems
   ➢ Select the appropriate approach to identify causes of the problem based on the given situation
   ➢ Perform systematic analysis to identify problem causes using the best available tools and processes
   ➢ Listen for input and ask critical questions to identify the problem and its possible causes
   ➢ Identify, develop and test potential solutions, and develop resolution plan
   ➢ Identify the potential risks in implementation, assess the cost/benefit of implementation alternatives (including non-implementation), and make recommendations
   ➢ Communicate and implement solution in a manner that minimizes risk and disruption to productivity
   ➢ Document and communicate problem, analysis and resolution process, solution and outcome
   ➢ Develop recommendations for prevention of problem recurrence
   ➢ Evaluate effectiveness of processes, tools and communication used in problem resolution and develop recommendations for continuous improvement

Performance Indicators – Proficiency level
Demonstrate the ability to:
   ➢ Identify problems in a timely manner
   ➢ Identify a wide range of problems
   ➢ Effectively use a wide range of troubleshooting techniques
   ➢ Effectively use a wide range of troubleshooting tools
   ➢ Select the troubleshooting tools and methods most appropriate for the problem at hand
   ➢ Use logic to eliminate possible causes
   ➢ Select probable causes through a process of elimination and deduction
   ➢ Listen to inputs from the user's experience with the problem
   ➢ Ask critical questions to develop an accurate picture of the problem and its possible causes
   ➢ Create solutions appropriate to the problem and in line with available resources
   ➢ Test potential solutions ensuring low risk to the overall system
   ➢ Implement solutions in a timely and efficient manner

    ➢ Document the problem, process and resolution
    ➢ Communicate with users and other critical parties
    ➢ Follow-up after resolution

Performance Indicators – Expert level
Demonstrate the ability to:
    ➢ Develop a solution implementation strategy
    ➢ Assess the risks and benefits of parallel solutions
    ➢ Document and communicate the implementation plan
    ➢ Assess impact of the problem and proposed solutions on project
    ➢ Monitor the implementation process and readjust to better meet goals
    ➢ Assess the effectiveness of the troubleshooting process and tools
    ➢ Make recommendations for improvement in the troubleshooting process
    ➢ Make recommendations for preventing recurrence of the problem
    ➢ Assess the team process in problem solving and make recommendations for improvement

Professional Development/ Self-Learning – *Foundation Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to identify and close gaps between one's knowledge and skills and those required by the situation
➢ Demonstrate the ability to evaluate one's strengths and build upon them
➢ Demonstrate the ability to identify sources of learning/training most appropriate for the subject and for one's personal learning style

Key Competencies
Demonstrate the ability to:
  ➢ Describe different learning styles, and explain which learning strategies best apply to each style
  ➢ Identify one's own learning style and most effective learning forums
  ➢ Recognize what skills and knowledge are needed to work on a specific project or in a specific environment
  ➢ Anticipate the needs for new skills and knowledge based on changes in responsibilities and/or technologies
  ➢ Assess personal skills and knowledge against identified needs
  ➢ Assess objectively one's strengths and current knowledge
  ➢ Build upon one's strengths and current knowledge to develop new skills
  ➢ Leverage team resources to further one's own skills and knowledge
  ➢ Evaluate the portability of one's skills to new areas of application
  ➢ Research and evaluate options for training and education
  ➢ Evaluate effectiveness of specific training or education programs in the context of identified needs, and available time and resources
  ➢ Take advantage of on-the-job or on-the-project self-learning opportunities

Performance Indicators – Proficiency level
Demonstrate the ability to:
  ➢ Describe different learning styles
  ➢ Explain what types of training fit best specific learning styles
  ➢ Identify one's own learning style and preferences in acquiring information
  ➢ Assess a particular learning forum's effectiveness in light of the subject or skill being taught
  ➢ Apply effective learning and studying skills
  ➢ Effectively use online training resources
  ➢ Assess one's own skills and knowledge in a given context
  ➢ Develop a gap analysis of one's own knowledge and skills against a standard
  ➢ Identify the needs for specific knowledge and skills for a given project or in a given environment
  ➢ Research options for further training or education
  ➢ Learn on-the-job or on-the-project
  ➢ Ask for informal training from others
  ➢ Learn from others experience and knowledge
  ➢ Assess one's readiness for further training
  ➢ Receive knowledge from a wide range of sources

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Performance Indicators – Expert level

Demonstrate the ability to:

➢ Develop a personal training and education plan
➢ Anticipate the needs for new skills and knowledge in response to technology changes
➢ Conduct a job skills analysis
➢ Evaluate the effectiveness of a training or education forum against learning goals
➢ Select training or education forums that best meet needs, and available time and resources
➢ Assess the portability of one's skills to a new application area
➢ Assess the needs for new skills and knowledge when placed in a new environment
➢ Develop a flexible learning style
➢ Recognize the importance of continuous learning in a technology environment
➢ Recognize the impact of the organization culture on skill expectations

Professional Environment – *Foundation Learning Component*

Learner Program Outcomes
➢ Demonstrate successful work environment-related attitudes and skills
➢ Demonstrate the ability to establish and maintain professional relationships

Key Competencies
Demonstrate the ability to:
➢ Identify employer expectations regarding job performance and attitudes
➢ Explain the basics of and rationale for work ethics
➢ Exhibit appropriate work habits and attitudes
➢ Discuss issues of confidentiality, and explore behaviors and procedures to support company's policies in data confidentiality
➢ Take pride in one's work and assume responsibility for personal actions
➢ Explain and work within the organization hierarchy and reporting procedures
➢ Accept constructive criticism and exhibit continual growth based on feedback and performance evaluation
➢ Make appropriate and timely decisions based on facts, legality, ethics, purpose and culture
➢ Display a positive attitude, project a professional image, and foster a productive environment
➢ Identify characteristics of effective leaders, and demonstrate initiative and leadership skills
➢ Explain the need and benefits of maintaining a strong professional network
➢ Recognize and effectively use opportunities and forums to establish professional relationships
➢ Foster and develop successful professional relationships

Performance Indicators – Proficiency level
Demonstrate the ability to:
➢ Define one's role and responsibilities in a given context
➢ Explain what work ethics mean
➢ Give examples of behaviors that support and behaviors that undermine the functioning of the organization
➢ Explain how personal values impact one's work performance
➢ Display effective work behaviors
➢ Explain issues affecting confidentiality policies
➢ Give examples of behaviors/procedures that support and behaviors/procedures that undermine confidentiality
➢ Show pride in one's work accomplishments
➢ Acknowledge responsibilities and assume responsibility for personal actions
➢ Explain the purpose of a hierarchical structure and the various forms of organizational structures
➢ Discuss legal issues and how they affect an organization
➢ Explain cultural differences and how they affect an organization
➢ Display a positive attitude in a wide range of contexts

➢ Give examples of behaviors that contribute to professionalism and demonstrate a professional image
➢ Ask for and receive constructive criticism
➢ Explain the reasons for developing a strong professional network
➢ Recognize opportunities to establish professional relationships
➢ Develop and maintain a successful professional network

Performance Indicators – Expert level

Demonstrate the ability to:
➢ Explain how cultures and organization goals will impact performance and attitude expectations
➢ Describe different organizational cultures in the business environment and their advantages and disadvantages
➢ Explain what contributes to a productive environment
➢ Discuss leadership skills and roles
➢ Display leadership skills in a variety of contexts
➢ Assess one's performance against expectations
➢ Develop strategies to improve performance
➢ Seek and use feedback on personal performance and effectiveness from a wide range of sources
➢ Balance work load and responsibilities with personal needs and preferences
➢ Make effective decisions and display initiative in a wide range of contexts
➢ Adapt one's professional network to one's professional goals

Project Management – *Foundation Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to explain the purpose of, and participate in all the phases of project management
➢ Demonstrate the ability to use appropriate project management planning tools and methods

Key Competencies
Demonstrate the ability to:
  ➢ Present the main steps and issues in project management
  ➢ Evaluate project requirements, and clearly define and articulate project scope and goals
  ➢ Identify stakeholders, decision-makers and escalation procedures
  ➢ Develop detailed task list and analyze relationships between separate tasks and the overall project
  ➢ Develop general project flow chart, identifying critical tasks and task interdependencies
  ➢ Identify project time, personnel, budget and equipment requirements
  ➢ Map resource requirements to resource availability, secure necessary resources and use resources effectively
  ➢ Identify, evaluate and monitor risks throughout the project, and prepare contingency plans
  ➢ Identify critical milestones and project performance, budgets and the use of resources
  ➢ Identify a critical path failure, and implement contingency plans when necessary
  ➢ Participate in and actively contribute to project reviews
  ➢ Document and report project status in a timely manner using appropriate channels
  ➢ Work effectively within the system and with members of the team and organization

Performance Indicators - Proficiency Level
Demonstrate the ability to:
  ➢ Evaluate project requirements
  ➢ Identify decision makers
  ➢ Define project scope and goals
  ➢ Identify escalation procedures
  ➢ Break down a project into component tasks
  ➢ Articulate task interdependencies
  ➢ Organize and prioritize tasks
  ➢ Project resource needs such as human, time, budgetary and equipment resources
  ➢ Identify and match resources to tasks
  ➢ Establish criteria, format and timelines to monitor tasks
  ➢ Monitor the use of resources
  ➢ Evaluate processes and products during and at the end of the project
  ➢ Use evaluation information to adjust activities to meet goals
  ➢ Evaluate and monitor risks throughout the project
  ➢ Contribute effectively to project reviews
  ➢ Document and report status in an appropriate and timely manner

Performance Indicators - Expert Level
Demonstrate the ability to:
- ➢ Develop performance measurement processes
- ➢ Establish a process for making task adjustments
- ➢ Anticipate and resolve conflicts as they arise
- ➢ Identify critical milestones and their impact on project
- ➢ Identify critical path failure
- ➢ Develop contingency plans
- ➢ Recognize the need for escalation
- ➢ Work effectively within the system
- ➢ Analyze project management process and make recommendations for improvement

Proposal Writing – *Foundation Learning Component*

Learner Program Outcomes
➢ Demonstrate ability to explain necessary elements of a proposal and its respective purpose
➢ Demonstrate ability to develop a proposal that meets client's requirements and effectively presents the phases of the project

Key Competencies
Demonstrate the ability to:
   ➢ Explain the proposal development process
   ➢ Identify the key parts of a proposal and what contributes to an effective proposal
   ➢ Develop an effective outline for a proposal
   ➢ Develop concepts for the project and analyze effectiveness of each concept
   ➢ Effectively present and justify selected concepts
   ➢ Summarize relevant background and research material to support proposal
   ➢ Develop a realistic estimate for budget, schedule and resources
   ➢ Clearly present the different phases of the project and their interdependencies
   ➢ Identify risks and present contingencies
   ➢ Present the overall proposal in a level of details that meets the needs of the audience
   ➢ Negotiate elements of the proposed work with clients and project team, and refine proposal accordingly

Performance Indicators – Proficiency level
Demonstrate the ability to:
   ➢ Explain the purpose of a proposal
   ➢ Explain the necessary elements in a proposal
   ➢ Explain the proposal development process
   ➢ Develop a proposal idea
   ➢ Develop a proposal outline
   ➢ Develop potential concepts for the proposal
   ➢ Evaluate and select the best approach for the proposal
   ➢ Effectively present the concepts in the proposal
   ➢ Summarize relevant and supporting research
   ➢ Include supporting material and necessary justification
   ➢ Estimate project budget with enough accuracy and detail for the proposal
   ➢ Estimate project schedule with enough accuracy and detail for the proposal
   ➢ Estimate project resources with enough accuracy and detail for the proposal
   ➢ Present clearly the proposed phases for the project
   ➢ Develop proposal that is cohesive, complete and easy to read

Performance Indicators – Expert level
Demonstrate the ability to:
   ➢ Analyze a proposal for effectiveness and completeness
   ➢ Identify risk of the proposal and develop contingencies
   ➢ Analyze customer culture & expectations, apply to proposal design, content & layout
   ➢ Negotiate elements of the proposal with clients, if possible, and with team members throughout the proposal development process

Task Management – *Foundation Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to organize multiple tasks in the most effective way and allocate time and energy according to task complexity and priority
➢ Demonstrate the ability to evaluate task outcomes and continuously improve organization process

Key Competencies
Demonstrate the ability to:
➢ Break down projects and activities into a series of tasks
➢ Identify task priorities and interdependencies, and organize in a logical sequence
➢ Estimate time and resources necessary to complete specific tasks
➢ Develop realistic schedule and effective work processes to accomplish assigned tasks
➢ Recognize and resolve conflicts in the use of resources or in goals between separate tasks
➢ Secure or request resources in a timely manner to accomplish tasks according to schedule
➢ Conduct effectively, and monitor several tasks simultaneously
➢ Monitor and evaluate tasks performance and completion against project plan and standards
➢ Make process improvements and adjustments as tasks progress
➢ Evaluate the impact of one's work on the rest of the project and team
➢ Generate and communicate task status reports to peers and managers in the appropriate time and level of detail

Performance Indicators – Proficiency level
Demonstrate the ability to:
➢ Detail work assignments in a series of tasks
➢ Develop task list that is realistic and in line with expectations
➢ Prioritize tasks
➢ Accomplish tasks in an efficient manner and on schedule
➢ Show initiative in task accomplishment and scheduling
➢ Explain task interdependencies
➢ Explain impact of one's work on other project members
➢ Monitor one's work while in progress
➢ Estimate time and resources needed to complete assigned tasks
➢ Develop personal work schedule and processes that meet expectations and align with personal work style
➢ Communicate and report problems in a timely manner
➢ Generate task status reports
➢ Organize one's work environment to best accomplish tasks
➢ Recognize when a task is completed to expectations
➢ Display flexibility in task organization and act responsively to unplanned demands

Performance Indicators – Expert level

Demonstrate the ability to:

➢ Assess one's work process in terms of effectiveness
➢ Devise ways to improve one's work processes
➢ Conduct and monitor several tasks simultaneously
➢ Develop and implement monitoring processes and check-points
➢ Recognize and address conflicts in task assignment
➢ Explain the contribution of one's work towards the overall project goals
➢ Assess task assignments against perceived role and responsibilities
➢ Delegate responsibilities to others when appropriate
➢ Assess the impact of others work on one's work processes
➢ Anticipate and prepare for changing work loads
➢ Coordinate tasks with team project members

Team Work – *Foundation Learning Component*

Learner Program Outcomes
- Demonstrate the ability to work collaboratively in a team setting
- Demonstrate the ability to work and communicate effectively with people of different backgrounds and expertise in a group environment
- Demonstrate the ability to recognize expertise in others, and to learn from others

Key Competencies
Demonstrate the ability to:
- Explain different team processes, roles and group dynamics, their purposes, advantages and disadvantages
- Use effectively a variety of listening, communication and interactive styles and strategies, and recognize their appropriateness depending on the team environment and goals
- Respect and work collaboratively with differences in backgrounds, opinions and communication styles
- Recognize and respect cultural, ethnic and linguistic diversity
- Recognize and leverage strengths in one's self and others to further the team goals
- Foster an environment that supports risk taking in freely disclosing ideas and opinions
- Identify and support productive ideas and processes that contribute to the goals of the team
- Function effectively in different roles within the team, and show flexibility in accepting others' leadership
- Manage conflicts in a productive manner, and work collaboratively to set and accomplish team goals
- Learn from and teach other members of the team

Performance Indicators – Proficiency level
Demonstrate the ability to:
- Describe different team processes and group dynamics
- Compare the effectiveness of different processes in light of the team purpose
- Contribute effectively to group processes
- Display flexibility with one's own style of participation to accommodate changes in the team dynamics and focus
- Listen actively and contribute ideas in an effective manner
- Recognize differences and adjust communication style accordingly
- Respect and work effectively in an environment of cultural, ethnic and linguistic diversity
- Build upon the strengths of team members
- Function in different roles within a team environment
- Take risks in contributing to the team process
- Support other team members
- Ask for help from the team when needed
- Share knowledge with others and work effectively in a collaborative environment
- Communicate with other team members in a timely manner
- Recognize and present the big picture

Performance Indicators – Expert level

Demonstrate the ability to:

➢ Discuss the advantages of a diverse culture and its benefits to the overall productivity of the organization
➢ Present the issues encountered in a diverse organizations and effective strategies to address these issues
➢ Organize and run a brainstorming session
➢ Apply effective conflict resolution strategies
➢ Explain the role of team work in various settings and organizations
➢ Anticipate and address the needs of the team
➢ Recognize and foster processes that contribute to the overall team purpose
➢ Assess the effectiveness of the team process
➢ Make recommendations for improvement in the team working process
➢ Organize, manage and facilitate a wide range of team processes
➢ Coordinate tasks with project team members
➢ Evaluate and critique team members' contribution

User Validation – *Foundation Learning Component*

Learner Program Outcomes
➢ Demonstrate the ability to develop and implement an effective testing program that supports all phases of the development process

Key Competencies
Demonstrate the ability to:
> ➢ Develop a usability test plan that meets the project goals and scope, and company policies
> ➢ Design specific usability tests to measure critical elements of the project at critical times in the project
> ➢ Define the target audience, the feedback process, the testing procedure and the test sample population for each series of tests
> ➢ Plan and coordinate customer acceptance testing
> ➢ Select and apply efficiently appropriate usability testing tools and techniques
> ➢ Conduct usability tests in the most efficient way
> ➢ Analyze and document test results in a complete and unbiased manner
> ➢ Summarize test results and draw appropriate recommendations
> ➢ Implement changes based on test results, and communicate results and recommendations to appropriate team members and clients
> ➢ Evaluate the effectiveness of the testing plan and procedures on a continuous basis
> ➢ Assess overall product effectiveness & performances, perform summative evaluation

Performance Indicators – Proficiency level
Demonstrate the ability to:
> ➢ Develop test plans for specific purposes
> ➢ Design specific test processes and procedures
> ➢ Define the test sample population characteristics
> ➢ Develop appropriate feedback process
> ➢ Develop hardware and functionality testing procedure
> ➢ Conduct tests in an effective manner
> ➢ Select appropriate testing tools and procedures
> ➢ Analyze test results
> ➢ Document testing procedures and results
> ➢ Draw appropriate conclusions and make recommendations
> ➢ Implement changes based on test results
> ➢ Communicate results and recommendations

Performance Indicators – Expert level
Demonstrate the ability to:
> ➢ Explain the impact of company policies on test plans
> ➢ Identify appropriate timing at different phases of the project to implement testing
> ➢ Develop customer acceptance testing plan
> ➢ Analyze effectiveness of testing tools and procedures
> ➢ Analyze effectiveness of overall testing plan and make recommendations
> ➢ Develop cost/benefit analysis of alternate testing plans
> ➢ Assess overall product effectiveness based on test result summary

SAMPLE ACTIVITIES

➢ **Activity**

➢ **Suggested Assessments for Activity**

➢ **Primary Outcomes Addressed by Activity**

The Learning Activities integrate the technical and foundation Program Competencies.

General Notes on Projects

➢ The following projects are based on a fictitious company named Bellpeek. A brief company profile and the diagram of its current computer system are included at the end of this section.

➢ Each project can be accomplished through individual student or team efforts. If teams are used to accomplish a project, competencies from the Team Work learning component can be added as performance indicators for the specific project.

➢ Even though projects 2, 3 and 4 build on the results of the preceding project, it is not necessary for the students to have participated or completed the preceding project. Students will be given a compiled package of information based on successful results gathered in the preceding project.

Project 1 : Analysis and Proposal Development

Bellpeek Software wants to track inventory for input components into the production process (4 components purchased from 9 suppliers), and track production processes and status through a database management system. Currently inventory is tracked manually on a paper trail and there is no production process control used.

You have been asked to analyze the systems requirements and upgrade needs, and develop a proposal to meet Bellpeek's production tracking requirements.

After evaluating the existing system, you are to make recommendations for system hardware and software upgrades, if needed, to support the new tracking system. The proposal should include the following:
- ➢ Proposed hardware and software upgrade, and system design concepts
- ➢ An estimate of the time and cost for the development and implementation phases
- ➢ A scope of work and timeline for each of the design, prototype and implementation phases
- ➢ A detailed staff and equipment needs list
- ➢ Estimated people hours and equipment costs for each phase of the development and implementation project
- ➢ An evaluation of the risks involved in the design and change process, along with proposed recovery plans

You will also conduct a cost/benefit analysis of the proposed system as compared to the current process used at Bellpeek to support Bellpeek management decision in proceeding with the system upgrade. This should take into account intangible costs, such as error rates in current system, downtime on production floor due to lack of available components, training on the new system, and downtime during implementation of the new system.

The proposal document, with supporting analysis, will be assembled and delivered to the instructor at the end of the project. Each student will also make a brief in-class presentation summarizing the highlights of his/her proposal and recommendations.

Primary Competencies Addressed by Project:
Business Communication
- ➢ Identify the appropriate communication format for a specific purpose and situation
- ➢ Use clear, focused, specific, and grammatically correct language and terminology
- ➢ Act in a courteous and professional manner when communicating with others using a degree of formality appropriate to the situation
- ➢ Balance visual and verbal elements, and text in written communication and presentations
- ➢ Prepare oral presentations that accurately convey specific technical information and that are appropriate for various audiences

Proposal Writing
- ➢ Identify the key parts of a proposal and what contributes to an effective proposal

➢ Develop an effective outline for a proposal
➢ Develop concepts for the project and analyze effectiveness of each concept
➢ Effectively present and justify selected concepts
➢ Summarize relevant background and research material to support proposal
➢ Develop a realistic estimate for budget, schedule and resources
➢ Clearly present the different phases of the project and their interdependencies
➢ Identify risks and present contingencies
➢ Present the overall proposal in a level of details that meets the needs of the audience

Systems Analysis
➢ Interpret and evaluate requirements for completeness, relevance, accuracy and consistency
➢ Identify time, technology and resource constraints
➢ Develop high level systems and functional specifications
➢ Perform data flow, event analysis and object modeling
➢ Develop concepts including alternatives and prepare a cost/benefit estimate for each option
➢ Identify risks and their impact on the overall project
➢ Define general scope of work to meet requirements and constraints
➢ Develop business process and logical data model

Suggested Assessments:
➢ Instructor or outside expert evaluates the completeness and validity of the proposal
➢ Instructor or outside expert evaluates the writing for organization, clarity and correctness
➢ Teams of students evaluate other students' proposals for completeness and validity
➢ Instructors and/or student peers evaluate in-class presentations for clarity, organization and persuasiveness

Project 2 : Design Process

Bellpeek Software wants to track inventory for input components into the production process (4 components purchased from 9 suppliers), and track production processes and status through a database management system. Currently inventory is tracked manually on a paper trail and there is no production process control used.

You have been asked to design a new production tracking system based on the proposal information developed in project 1*. After analyzing design concepts presented in the proposal you are to:
- Develop the physical database schema
- Develop specifications for client machine interface
- Integrate the new tables with the existing schema
- Design the user interface
- Develop and test prototypes

Use one of the following prototype/design tools:
- Event analysis with state transition diagram
- Use Case Jacobson
- Data flow diagram

Your deliverable is to develop the physical design document to be handed off to the programmer. This document will be submitted to your instructor for review.

> * Students will be given a compiled package of information based on successful results gathered in project 1. It is not necessary for the students to have participated or completed project 1.

Primary Competencies Addressed by Project:

Client Programming
- Define the constraints of the application architecture
- Develop data, application and interface schema to meet business process requirements
- Develop and test prototypes
- Make recommendation for design changes based on prototyping test results
- Participate and conduct design and development reviews
- Document design and development, and changes in design according to company policies

Database Design
- Model data and design database structure
- Develop database business applications that meet the needs of the client

Systems Design
- ➢ Specify major subsystems and interfaces
- ➢ Develop detail design specifications
- ➢ Select design methodology and tools
- ➢ Perform feasibility studies of design alternatives
- ➢ Identify physical requirements for systems implementation
- ➢ Prepare and conduct design reviews
- ➢ Identify impact on existing systems
- ➢ Perform usability testing and human factor analysis
- ➢ Establish security requirements

Task Management
- ➢ Break down projects and activities into a series of tasks
- ➢ Identify task priorities and interdependencies, and organize in a logical sequence
- ➢ Estimate time and resources necessary to complete specific tasks
- ➢ Develop realistic schedule and effective work processes to accomplish assigned tasks
- ➢ Monitor and evaluate task performance and completion against project plan and standards
- ➢ Evaluate the impact of one's work on the rest of the project and team

Technical Documentation
- ➢ Write in a concise and precise form appropriate for technical documentation
- ➢ Record system specifications accurately and completely
- ➢ Prepare materials written to convey specific technical problems, their related issues, and their solutions
- ➢ Document design changes as they are adopted
- ➢ Create and update documentation through all phases of the systems life cycle
- ➢ Use Case tools to assist in system documentation

User Interface Design
- ➢ Define the requirements for the user interface
- ➢ Develop user interface schema to meet user requirements
- ➢ Develop and test prototypes
- ➢ Make recommendation for design changes based on prototyping test results
- ➢ Participate and conduct design and development reviews

Suggested Assessments:
- ➢ Instructor or outside expert evaluates the completeness and validity of the specification and technical document
- ➢ Instructor or outside expert evaluates writing for organization, clarity and correctness
- ➢ Instructor or outside expert assesses whether design meets application requirements
- ➢ Teams of students evaluate other students' specification and technical document for completeness and validity
- ➢ Instructors or outside expert evaluates the students' ability to follow industry guidelines and standards in the design process

Project 3 : Coding and Testing

Bellpeek Software wants to track inventory for input components into the production process (4 components purchased from 9 suppliers), and track production processes and status through a database management system. Currently inventory is tracked manually on a paper trail and there is no production process control used.

Based on the physical design document developed in project 2, you have been asked to develop the application and test it, using first Access VBA, and then VB/ Data Access.

You are to:
➢ Write code
➢ Insert the necessary product information into tables
➢ Update inventories, components and products
➢ Develop business rules
➢ Develop test plan for the program
➢ Perform module test procedures
➢ Perform integration subsystem testing
➢ Prioritize solutions to problems in terms of cost/time factors
➢ Implement selected solutions

You will be required to keep a log of the coding and testing process to record bugs and fixes, design changes, testing plan and procedures, test results and recommendations, and solution implementation. This log will be submitted to your instructor.

* Students will be given a compiled package of information based on successful results gathered in project 2. It is not necessary for the students to have participated or completed project 2.

Primary Competencies Addressed by Project:

Client Programming
➢ Construct database, application programs, and system and user interfaces for flexibility and adaptability
➢ Perform unit and system tests, and troubleshoot problems
➢ Follow organization standards for development
➢ Establish performance standards and quality checks
➢ Install and test integrated solution

Database Design
➢ Design, Create and utilize relational databases
➢ Create and edit tables, develop complex queries and create reports
➢ Create and customize forms and reports
➢ Use intrinsic programming language
➢ Develop database business applications that meet the needs of the client
➢ Explain database normalization and normalize database tables

➢ Use object oriented development environment
➢ Use joins to link appropriate tables in query

Programming Language – Visual Basic
➢ Explain and apply the basic concepts of programming
➢ Explain and effectively use the Visual Basic design process
➢ Define and appropriately use standard, advanced and graphic Visual Basic controls
➢ Define and appropriately use the Visual Basic data types, variables and procedures
➢ Define and appropriately use decision and repetition structures
➢ Define and appropriately use the Visual Basic menus and dialog boxes
➢ Define and appropriately use the Visual Basic data access methods
➢ Write, compile, debug and execute programs in Visual Basic
➢ Troubleshoot Visual Basic programs
➢ Build well engineered and maintainable Visual Basic programs to meet business applications
➢ Define and develop appropriate class modules
➢ Develop and appropriately use code components

Technical Documentation
➢ Write in a concise and precise form appropriate for technical documentation
➢ Explain and use the processes and techniques of technical documentation
➢ Prepare materials written to convey specific technical problems, their related issues, and their solutions
➢ Adhere to documentation industry and organization guidelines and standards

Testing and Debugging
➢ Select debugging and testing methodology, and develop comprehensive and systematic test plan
➢ Select program debugging tools and techniques
➢ Develop testing procedures
➢ Conduct tests in the most efficient way
➢ Test programs, and document errors and solutions
➢ Select testing tools and develop test system
➢ Perform system integration testing
➢ Perform volume/performance testing
➢ Analyze and document test results following policies and procedures
➢ Summarize test results and make appropriate recommendations
➢ Implement changes based on test results, and communicate results and recommendations to appropriate team members and clients

User Interface Design
➢ Construct user interfaces for flexibility and adaptability
➢ Perform user interface tests, and troubleshoot problems

Suggested Assessments:
- ➢ Instructor, outside experts and/or student peers evaluate the application for ease of use, reliability and its ability to meet user requirements
- ➢ Instructor or outside expert evaluates the clarity, correctness and organization of the development log
- ➢ Instructor or outside expert evaluates he program for flexibility and elegance
- ➢ Instructor or outside expert evaluates the testing process for organization, effectiveness and thoroughness

Project 4 : User Acceptance Testing

Bellpeek Software wants to track inventory for input components into the production process (4 components purchased from 9 suppliers), and track production processes and status through a database management system. Currently inventory is tracked manually on a paper trail and there is no production process control used.

You have been asked to design and organize user acceptance testing for the system developed in project 3. The user acceptance test plan and supporting material should include:
- ➢ A scope, timeline and estimated cost for the test
- ➢ A list of features to be tested by users, along with a recommended test sequence
- ➢ A profile for the type of users to be selected to participate in the acceptance testing
- ➢ A detailed testing process document to be handed off to the persons implementing the test process with the users
- ➢ Technical process sheets to be given to the users during the acceptance testing process
- ➢ Clear, easy to read and follow directions to the users

You will then:
- ➢ Test your proposed user acceptance testing plan and process on a limited sample of users (5 to 10 users)
- ➢ Summarize the results
- ➢ Make recommendations for design changes with associated cost/time to redesign
- ➢ Evaluate the effectiveness of your user acceptance testing plan and process
- ➢ Make recommendations for improvement

A report documenting the user acceptance testing plan and process, with supporting documentation and analysis, with be delivered to the teacher mid project. A report summarizing implementation results, observations and recommendations will be delivered at the end of the project.

> * Students will be given a compiled package of information based on successful results gathered in project 3. It is not necessary for the students to have participated or completed project 3.

Primary Competencies Addressed by Project:

Business Communication
- ➢ Identify the appropriate communication format for a specific purpose and situation
- ➢ Use clear, focused, specific, and grammatically correct language and terminology
- ➢ Act in a courteous and professional manner when communicating with others using a degree of formality appropriate to the situation
- ➢ Analyze communication to effectively extract content and underlying issues
- ➢ Communicate effectively with audiences of various degrees of expertise in a wide range of technical and business contexts

Client Relations
- ➢ Listen to the clients input and ask critical questions to differentiate between the actual needs and desires
- ➢ Solicit feedback from clients and apply input to improve the quality of service
- ➢ Recognize the client's level of experience and expertise, and tailor training and communication accordingly
- ➢ Recognize proprietary information and respect clients' confidentiality

User Validation
- ➢ Develop a usability test plan that meets the goals and scope of the project, and company policies
- ➢ Design specific usability tests to measure critical elements of the project at critical times in the project
- ➢ Define the target audience, the feedback process, the testing procedure and the test sample population for each series of tests
- ➢ Plan and coordinate customer acceptance testing
- ➢ Select and apply efficiently appropriate usability testing tools and techniques
- ➢ Conduct usability tests in the most efficient way
- ➢ Analyze and document test results in a complete and unbiased manner
- ➢ Summarize test results and draw appropriate recommendations
- ➢ Evaluate the effectiveness of the testing plan and procedures on a continuous basis
- ➢ Assess overall product effectiveness and performances, and perform summative evaluation

Suggested Assessments:
- ➢ Instructor or outside expert review documents for organization, clarity and completeness
- ➢ Instructor or outside expert evaluates the completeness and validity of the test plan
- ➢ Instructor, outside experts or student peers evaluate the completeness and effectiveness of the test plan and processes
- ➢ Instructor, outside experts or student peers evaluate the ease-of-use and effectiveness of the directions to users
- ➢ Instructor or outside expert review the selection process for the user validation sample
- ➢ Instructor, outside experts or student peers evaluate the validity of the conclusions from the user validation test and the appropriateness of the recommendations
- ➢ Users from the sample group evaluate the students' ability to interact with them in a professional manner and answer questions

Project 5 : Project Management and Quality Assurance

Bellpeek Software wants to track inventory for input components into the production process (4 components purchased from 9 suppliers), and track production processes and status through a database management system. Currently inventory is tracked manually on a paper trail and there is no production process control used.

The company wants to hire an outside consultant to manage the entire process from proposal and concept development, through implementation. The company has a strong commitment to quality assurance and is looking for a candidate who shares this commitment.

You are interested in the job and have been asked to prepare a portfolio including the following:
 ➢ A résumé highlighting what areas in your background, experience and abilities make you a strong candidate for this position

 ➢ What project management processes and tools would you set in place for this project if you were hired for the job? —
   - how would you organize the team,
   - how would you communicate with the team during the different phases of the project,
   - how would you organize the tasks,
   - how would you keep track of timelines, budgets, resources…

 ➢ What quality assurance checkpoints and process would you set in place for this project if you were hired for the job? —
   - when and how would you check on the quality of the development and implementation processes,
   - what types of records would you keep,
   - what kind of communication strategies would you put in place to ensure quality throughout the project…

The report will be assembled and delivered to the instructor. Each student will also make a brief in-class presentation summarizing the highlights of his/her report.

Primary Competencies Addressed by Project:

Business Communication
 ➢ Use clear, focused, specific, and grammatically correct language and terminology
 ➢ Balance visual and verbal elements, and text in written communication and presentations

Professional Development/ Self-Learning
 ➢ Recognize what skills and knowledge are needed to work on a specific project or in a specific environment
 ➢ Assess personal skills and knowledge against identified needs

➢ Assess objectively one's strengths and current knowledge
➢ Evaluate the portability of one's skills to new areas of application

Project Management
➢ Present the main steps and issues in project management

Quality Assurance
➢ Discuss quality processes, issues, challenges and trends in today's business environment
➢ Present the critical elements of design and development for quality
➢ Discuss how communication is an intrinsic part of quality

Team Work
➢ Explain different team processes, roles and group dynamics, their purposes, advantages and disadvantages

Suggested Assessments:
➢ Instructor, outside experts or student peers evaluate the completeness and effectiveness of the report
➢ Instructor, outside experts or student peers evaluate the completeness and effectiveness of the presentation
➢ Instructor or outside expert evaluates the writing for organization, clarity and correctness
➢ Instructors and/or student peers evaluate in-class presentations for clarity, organization and persuasiveness
➢ Instructor or outside expert evaluates the students' ability to effectively present their skills, and convey the portability and relevance of their knowledge
➢ Instructor or outside expert evaluates the students' ability to discuss issues of quality assurance as it relates to application development and implementation

Bellpeek Software — Company Profile

Bellpeek Software develops and markets a number of "shrink-wrapped" computer applications. These include a word processing program, a spreadsheet and a database management system, among others. The company's market area covers the entire United States. The company is committed to providing a wide range of user-friendly software to the widest possible pool of software distributors.

The computer system presently in use includes a Pentium PC for client/server applications, and a number of personal computers that are all networked together either by Ethernet or a communications link. A diagram showing the hardware configuration is attached.

Bellpeek sells their products (currently 13) to customers (seventy-one) in six regions. Four different types of components are purchased from nine suppliers and turned into finished goods which are then sold to distributors.

Currently Bellpeek is not tracking inventory or the production process.

CURRICULUM MAP

The Curriculum Map distributes the program competencies into specific courses.

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Client Programming – *Technical Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to explain and apply the necessary phases of application development in a Client/Server environment, with emphasis on the client component	*Demonstrate the ability to:* • Define Client/Server model • Describe "n-Tier Architecture" • Identify host languages for client applications • Describe the advantages and disadvantages of "thin-client" and "fat-client" implementations • Describe the role of "Business Objects" in a Client/Server environment • Create and test client applications • Create and test "middle-tier" applications • Describe the impact of Internet/Intranet functionality on Client/Server applications with emphasis on the client side	These competencies are emphasized in: • Client Programming I Visual Basic (IT 237) • Client Programming II Visual Basic (IT 238) • Systems Analysis (IT 160) • Systems Design (IT 260) Some of the competencies are also covered or practiced in: • Database Management (IT 290) • Web Database Development (IT 263)

Computer Applications– *Technical Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to use proficiently office software, including word processing, spreadsheet and Internet browser applications • Demonstrate the ability to apply office software applications to solve business problems	*Demonstrate the ability to* • Perform basic functions and configuration, and use available resources in a Windows environment • Create simple word processing documents, such as letters and memos, with appropriate format • Create compound word processing documents including drawings and objects from multiple software applications, such as embedded spreadsheets • Create word processing documents with formats and styles meeting purpose and needs of intended audience • Explain general spreadsheet design concepts and terminology • Create and modify spreadsheets, and create associated charts and graphs • Apply spreadsheet principles to solve business problems • Import and export data between different applications • Use browser applications to conduct effective searches on the Internet • Use the main functions of e-mail systems • Explain etiquette and proprietary issues when working with the Internet • Perform simple configuration of office software to meet specific needs • Use utility tools and perform basic troubleshooting of documents and spreadsheets	Most of these competencies are covered or practiced in the program prerequisite course: • Introduction to PC and Applications (IT 105) • Application Development VBA I (IT 127) • Application Development VBA II (IT 129) Some of the competencies are also covered or practiced in: • Introduction to Information Technology (IT 101) • Professional Report Writing (ENGL 270) Every course requiring students to use computer applications to develop documents or spreadsheets, or to use email as a communication tool or the Internet as a research tool helps students practice many of these competencies.

Computer Systems History and Trends– *Technical Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to discuss the issues affecting the selection of a computer system for a specific environment • Demonstrate the ability to present current computer technology and systems trends	*Demonstrate the ability to:* • Explain the purpose of gathering and managing information as an integral part of conducting business • Explore the issues of privacy and right of access to information • Explain the costs involved in installing or upgrading a computer system • Conduct a simple cost/benefit analysis for different systems in different business environments • Explain the evolution of computing system architectures • Discuss the main trends in information technology • Explain the main advantages and disadvantages of different system architectures • Explain the concepts of technology patenting, copyrighting, and software licensing • Explain the projected impact of the Internet on computer systems and applications	These competencies are emphasized in: • Introduction to Information Systems (IT 101) • Systems Analysis (IT 160) • Systems Design (IT 260) Some of the competencies are also covered or practiced in: • Operating Systems (IT 235) • Database Management (IT 290) • Introduction to Business (GBUS 101) • Accounting (ACCT 101) Written Expression (ENGL 101) and Professional Report Writing (ENGL 270) may cover some of these competencies if the reading and writing material is selected to address information technology related issues.

Database Design– *Technical Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to create and utilize relational databases, including modeling data, developing queries, customizing forms and reports, using code, creating charts and working with graphics • Demonstrate the ability to explain the importance of databases and information as a commodity in this high-tech age	*Demonstrate the ability to:* • Explain database design concepts and the role of database components • Model data and design database structure • Design, Create and utilize relational databases • Create and edit tables, develop complex queries and create reports • Create and customize forms and reports • Create graphs and add pictures to database elements • Use intrinsic programming language • Explain the use of databases and information in the business environment • Develop database business applications that meet the needs of the client • Explain database normalization and normalize database tables • Use object oriented development environment • Use joins to link appropriate tables in query	These competencies are emphasized in: • Client Programming II Visual Basic (IT 238) • Database Management (IT 290) • Web Database Development (IT 263) • Server Programming SQL Server (IT 239) • Access (AOS 168) • Application Development VBA I (IT 127) Some of the competencies are also covered or practiced in: • Introduction to Information Systems (IT 101)

Math and Science for Programmers– *Technical Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to explain and apply basic mathematical processes as they relate to programming; including statistics, logic, relational algebra, number systems, and cost/benefit analysis • Demonstrate the ability to explain and apply basic science processes as they relate to programming; including design of experimentation, data gathering and analysis, sensor performances	*Demonstrate the ability to* • Explain the principles and methods of basic statistical analysis, and apply to the design and analysis of test and survey scenarios • Explain the principles of logic and apply to the development of programming structures • Solve algebraic equations and correctly use algebraic functions in solving problems • Explain the basic principles of number systems and convert between different number systems • Explain the principles and methods of cost/benefit analysis, and apply to decision making in the context of system analysis • Explain the principles of experimentation design and apply to data gathering projects • Explain the principles and methods of data gathering and analysis, and relate to the reliability of experimental data • Develop sensor based acquisition systems and present the associated limitations in data accuracy	Some of these competencies are used in many of the courses, in particular they are strong foundations for the following courses: • Introduction to Programming (IT 110) • Application Development VBA I (IT127) • Application Development VBA II (IT 129) • Systems Analysis (IT 160) • Systems Design (IT 260) • Operating Systems (IT 235) • Database Management (IT 290) • Client Programming I Visual Basic (IT 237) • Client Programming II Visual Basic (IT 238) • Server Programming SQL Server (IT 239) • Web Database Development (IT 263) • Programming in C (IT 245) • Advanced C with Data Structures (IT 247) • C++ (IT 249) • Access (AOS 168) • Accounting (ACCT 101)

Network Architectures and Systems– *Technical Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to explain the design characteristics and components of network systems • Demonstrate the ability to design and implement simple network architectures • Demonstrate the ability to perform basic network hardware and software installation and configuration procedures, and troubleshoot basic network problems	*Demonstrate the ability to:* • Present the functions and design principles of network systems • Describe and explain purpose of network components • Describe and explain different network configurations and protocols • Present and discuss the processes of network administration • Present and discuss the issues of and strategies for network security • Design network systems for a wide range of environments • Perform basic installation/configuration of network components and software • Troubleshoot basic problems with software and hardware installation/configuration	These competencies are emphasized in: • Systems Analysis (IT 160) • Systems Design (IT 260) • Operating Systems (IT 235) • Introduction to Information Systems (IT 101) Some of the competencies are also covered or practiced in: • Client Programming II Visual Basic (IT 238) • Server Programming (IT 239) • Web Database Development (IT 263)

Network Operating Systems– *Technical Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to explain the characteristics of different network operating systems • Demonstrate the ability to install, use and configure most commonly used network operating systems	*Demonstrate the ability to:* • Explain the characteristics and the limitations of different network operating systems • Select an operating systems for a specific networking environment • Install and configure most commonly used network operating systems • Perform basic troubleshooting on network operating systems • Configure Windows 95 for networking environments • Explain the basic concepts and design principles of Windows NT • Operate in a Windows NT environment and work with Windows NT applications • Configure Windows NT server and workstations in an enterprise networking environment	These competencies are emphasized in: • Systems Analysis (IT 160) • Systems Design (IT 260) • Operating Systems (IT 235) • Introduction to Information Systems (IT 101)

Principles of Accounting– *Technical Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to explain and apply basic accounting principles • Demonstrate the ability to explain how computer applications support the financial workings of a business organization	*Demonstrate the ability to:* • Define and use appropriately basic accounting terminology • Record business transactions using recognized accounting principles • Explain and apply the principles of payroll accounting • Present the basic advantages and disadvantages of sole proprietorship, partnership and corporation from a financial perspective • Develop and analyze income statements, statements of capital and balance sheets • Make general recommendations based on financial statements • Develop models to represent financial administration systems • Use software tools to record financial transactions in a business environment • Use software tools to analyze the financial health of an organization • Explain how the different units of a business interact with the financial department • Discuss the forces and economic conditions that exist in operating a business	These competencies are emphasized in: • Accounting (ACCT 101) Some of the competencies are also covered or practiced in: • Introduction to business (GBUS 101) Every course requiring students to develop a proposal with a cost/benefit estimate helps students practice some of these competencies.

Programming Language – C– *Technical Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to write, compile, debug and execute well engineered and maintainable C programs that effectively meet the application requirements	*Demonstrate the ability to:* • Explain and apply the basic concepts of programming • Present the elements and features of the C programming environment • Explain and effectively use the C design process and structure • Define and appropriately use pointers, data types, arrays and data strings • Define and appropriately use decision and repetition structures • Define and appropriately use functions, recursion and storage classes • Use appropriately C operators and functions • Define and appropriately use dynamic data structures • Define and explain trends in C standards • Write, compile, debug and execute programs in C • Present the advantages and limitations of programming in C • Troubleshoot C programs • Build well engineered and maintainable C programs to **Course Map** meet business applications	These competencies are emphasized in: • Programming in C (IT 245) • Advanced C with Data Structures (IT 247)

Programming Language – C++– *Technical Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to write, compile, debug and execute well engineered and maintainable C++ programs that effectively meet the application requirements	*Demonstrate the ability to* • Explain and apply the basic concepts of programming • Present the elements and features of the C++ programming environment • Present the characteristics of object oriented programming • Explain and effectively use the C++ design process and structure • Use appropriately C++ operators and functions • Define and appropriately use pointers, data types, variables and arrays • Define and appropriately use constructor and destructor functions, and perform dynamic memory allocation • Define and appropriately use operator overloading • Define and appropriately use decision and repetition structures • Define and appropriately use inheritance mechanisms in C++ programming • Define and explain trends in C++ standards • Write, compile, debug and execute programs in C++ • Present the advantages and limitations of programming in C++ • Troubleshoot C++ programs • Build well engineered and maintainable C++ programs to meet business applications	These competencies are emphasized in: • C++ (IT 249)

Programming Language – SQL– *Technical Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to explain and apply the principles of SQL programming	*Demonstrate the ability to:* • Explain the purpose and use of Structured Query Language • Define and appropriately use SQL statements and logical operators • Perform data retrieval and relational joins using SQL • Perform data modification, including adding, updating and deleting rows • Define and appropriately use aliases and sub queries • Effectively manage and use views • Create and use indexes, triggers and cursors • Define effectively rules and defaults, and user restriction • Explain general administration responsibilities of a Database Administrator • Define and appropriately use joins • Create stored procedures with input and output parameters, and return values • Effectively manage user permissions	These competencies are emphasized in: • Client Programming I Visual Basic (IT 237) • Server Programming SQL Server (IT 239) • Web Database Development (IT 263) Some of these competencies are introduced in: • Database Management (IT 290) • Application Development VBA I (IT 127)

Programming Language – VB– *Technical Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to write, compile, debug and execute well engineered and maintainable VB programs that effectively meet the application requirements	*Demonstrate the ability to:* • Explain and apply the basic concepts of programming • Present the elements and features of the Visual Basic programming environment • Present the characteristics of object oriented programming • Explain and effectively use the Visual Basic design process • Define and appropriately use the standard, advanced and graphic Visual Basic controls • Define and appropriately use the Visual Basic data types, variables and procedures • Define and appropriately use decision and repetition structures • Define and appropriately use the Visual Basic menus and dialog boxes • Define and appropriately use the Visual Basic data access methods • Write, compile, debug and execute programs in Visual Basic • Present the advantages and limitations of programming in Visual Basic • Troubleshoot Visual Basic programs • Build well engineered and maintainable Visual Basic programs to meet business applications • Define and develop appropriate class modules • Develop and appropriately use code components • Integrate visual basic programs into Web applications	These competencies are emphasized in: • Application Development VBA I (IT 127) • Application Development VBA II (IT 129) • Client Programming I Visual Basic (IT 237) • Client Programming II Visual Basic (IT 238) Some of the competencies are also covered or practiced in: • Web Database Development (IT 263)

Quality Assurance– *Technical Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
- Demonstrate the ability to explain and apply quality assurance processes as they relate to programming - Demonstrate the ability to discuss quality issues in a technology organization	*Demonstrate the ability to:* - Discuss quality processes, issues, challenges and trends in today's business environment - Present the critical elements of design and development for quality - Establish processes and check points to monitor quality through all phases of the development process - Adhere to quality policies and procedures - Analyze models, description and prototypes for consistency, completeness and conformance to accepted rules of methodology - Discuss how communication is an intrinsic part of quality - Identify quality problems and propose solutions - Continuously review processes and tools to improve product quality	These competencies should be infused in all courses, especially the courses requiring students to develop programs and applications.

Server Programming– *Technical Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to explain and apply the necessary phases of application development in a Client/Server environment, with emphasis on the server component	*Demonstrate the ability to:* • Define Client/Server model • Describe "n-Tier Architecture" • Identify host languages for client applications • Describe the advantages and disadvantages of "thin-client" and "fat-client" implementations • Describe the role of "Business Objects" in a Client/Server environment • Create and test client applications • Create and test "middle-tier" applications • Describe the impact of Internet/Intranet functionality on Client/Server applications with emphasis on the client side	These competencies are emphasized in: • Server Programming SQL (IT 239) • Database Management (IT 290) Some of the competencies are also covered or practiced in: • Systems Analysis (IT 160) • Systems Design (IT 260)

Systems Analysis– *Technical Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to explain and apply the necessary processes, tools and skills used in the systems analysis phase of a project	*Demonstrate the ability to:* • Gather data to identify client requirements, resources and risks • Interpret and evaluate requirements for completeness, relevance, accuracy and consistency • Identify and resolve conflicting requirements • Identify time, technology and resource constraints • Resolve conflicts between requirements and constraints, and negotiate resolution with client • Develop high level systems and functional specifications • Perform data flow, event analysis and object modeling • Develop concepts including alternatives and prepare a cost/benefit estimate for each option • Identify risks and their impact on the overall project • Define general scope of work to meet requirements and constraints • Establish measurable performance requirements • Develop business process and logical data model	These competencies are emphasized in: • Systems Analysis (IT 160) These competencies are also practiced in program development projects.

Systems Design– *Technical Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to explain and apply the necessary processes, tools and skills used in the systems design phase of a project	*Demonstrate the ability to:* • Specify major subsystems and interfaces • Develop detail design specifications • Select design methodology and tools • Identify maintenance requirements • Perform feasibility studies of design alternatives • Identify physical requirements for implementation • Prepare and conduct design reviews • Identify impact on existing systems • Perform usability testing and human factor analysis • Develop test plan • Establish security requirements	These competencies are emphasized in: • Systems Design (IT 260) These competencies are also practiced in program development projects.

Technical Documentation– *Technical Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to select and use technical documentation formats meeting the intended purpose and the guidelines of the organization • Demonstrate the ability to develop effective and accurate technical documentation appropriate to various audiences and purposes	*Demonstrate the ability to:* • Write in a concise and precise form appropriate for technical documentation • Explain and use the processes and techniques of technical documentation • Record system specifications accurately and completely • Prepare materials written to convey specific technical problems, their related issues, and their solutions • Explain the purpose of logs, reports, training manuals and other forms of technical documentation • Adhere to documentation industry and organization guidelines and standards • Document design changes as they are adopted • Create and update documentation through all phases of the systems life cycle • Accurately document strengths and weaknesses of the system • Effectively organize the data in the systems repository • Effectively track multiple versions of a system documentation • Utilize Case tools to assist in system documentation	These competencies are emphasized in: • Professional Report Writing (ENG 270) And in all the courses asking students to develop and document programs and applications. Some of the competencies are also covered or practiced in: • Written Expression (ENG 101) Every course requiring students to write reports helps students practice many of these competencies.

Testing and Debugging– *Technical Learning Component*

Learner Program Outcomes	Key Competencies	Course Map
• Demonstrate the ability to apply debugging and testing tools and techniques • Demonstrate the ability to develop and apply systematic debugging and testing processes	*Demonstrate the ability to:* • Select debugging and testing methodology, and develop comprehensive and systematic test plan • Design testing programs to uncover hardware compatibility problems during the development phase of the project • Select program debugging tools and techniques • Develop testing procedures • Conduct tests in the most efficient way • Test programs, and document errors and solutions • Select testing tools and develop test system • Perform system integration testing • Perform volume/performance testing • Analyze and document test results following policies and procedures • Summarize test results and make appropriate recommendations • Implement changes based on test results, and communicate results and recommendations to appropriate team members and clients • Evaluate the effectiveness of the testing plan and procedures on a continuous basis • Assess overall product effectiveness and performances, and perform summative evaluation	These competencies are emphasized in all the courses requiring students to write and test code, and develop applications: • Application Development VBA I (IT127) • Application Development VBA II (IT 129) • Systems Analysis (IT 160) • Systems Design (IT 260) • Database Management (IT 290) • Client Programming I Visual Basic (IT 237) • Client Programming II Visual Basic (IT 238) • Server Programming SQL Server (IT 239) • Web Database Development (IT 263) • Programming in C (IT 245) • Advanced C with Data Structures (IT 247) • C++ (IT 249) • Access (AOS 168)

User Interface Design – *Technical Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to explain and apply the necessary processes, tools and skills used in effective user interface design	*Demonstrate the ability to:* • Define the requirements for the user interface • Define candidate solutions to business problem, and select best approach with client • Detail the development process and methods best suited for the project • Develop user interface schema to meet user requirements • Develop and test prototypes • Make recommendation for design changes based on prototyping test results • Participate and conduct design and development reviews • Document design and development, and changes in design according to company policies • Construct user interfaces for flexibility and adaptability • Perform user interface tests, and troubleshoot problems • Follow organization and industry standards for development • Establish performance standards and quality checks • Train system user on interface and perform user validation	These competencies are emphasized in: • Systems Analysis (IT 160) • Systems Design (IT 260) • Database Management (IT 290) • Client Programming I Visual Basic (IT 237) • Client Programming II Visual Basic (IT 238) • Web Database Development (IT 263) • Access (AOS 168)

Business Communications – *Foundation Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to select and exercise the appropriate communication vehicle for a specific purpose in a professional context • Demonstrate the ability to communicate effectively in technical and business environments	*Demonstrate the ability to:* • Explain the purpose and different uses of communication in business and industry • Identify the appropriate communication format for a specific purpose and situation • Communicate effectively using a wide range of communication formats • Use clear, focused, specific, and grammatically correct language and terminology • Act in a courteous and professional manner when communicating with others using a degree of formality appropriate to the situation • Analyze communication to effectively extract content and underlying issues • Communicate effectively with audiences of various degrees of expertise in a wide range of technical and business contexts • Balance visual and verbal elements, and text in written communication and presentations • Act responsively to audience, and adjust communication format and content accordingly • Prepare oral presentations that accurately convey specific technical information and that are appropriate for various audiences	These competencies are emphasized in: • Written Expression (ENG 101) • Professional Report Writing (ENG 270) Some of the competencies are also covered or practiced in: • Introduction to business (GBUS 101) • Internship I (GBUS 291) • Internship II (GBUS 292) Every course requiring students to write reports, make presentations, or communicate with faculty or students helps students practice many of these competencies.

Business Organization and Environment– *Foundation Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to discuss contemporary business principles, practices and organization, and a foundation of business terminology • Demonstrate the ability to discuss how computer systems impact the operation and management of business and society	*Demonstrate the ability to:* • Explain contemporary business concepts, principles and practices, and the legal and social aspects of the business environment • Explain the internal and external forces and economic conditions that affect the operation of a business • Explain different business organizations, their respective advantages and disadvantages, and how they operate • Explain the purpose of functional business areas including marketing, finance, accounting, research and development, manufacturing and management, and their relationships to one another • Explain and use appropriately general business terminology • Explain how and where computers are used in today's business, and discuss the impact of information systems on business operations • Discuss the issues of privacy and confidentiality in the context of the use of computer systems and the Internet in the business environment • Present the positive and negative impacts of computer technology on business and society, and discuss ethical issues in respect to the information age	These competencies are emphasized in: • Introduction to business (GBUS 101) • Survey of Accounting (ACCT 101) Some of the competencies are also covered or practiced in: • Internship I (GBUS 291) • Internship II (GBUS 292) • Introduction to Information Technology (IT 101) • Systems Analysis (IT 160) • Systems Design (IT260) • Client Programming I Visual Basic (IT 237) • Client Programming II Visual Basic (IT 238) • Server Programming (IT 239) • Web Database Development (IT 263)

Client Relations– *Foundation Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to effectively listen and ask critical questions to identify clients issues and concerns • Demonstrate the ability to resolve clients issues and concerns in a timely and appropriate manner	*Demonstrate the ability to:* • Explain the importance of clients in business, and the responsibilities of the business to its clients • Identify client interactions and dynamics within and outside the organization • Listen to the clients input and ask critical questions to differentiate between the actual needs and desires • Communicate product cost/benefit compromises and effectively negotiate with clients to arrive at a best-fit solution • Communicate project plan, status, risks and contingencies to clients in a timely manner and in an appropriate level of detail • Solicit feedback from clients and apply input to improve the quality of service • Schedule and manage effectively multiple clients' requests • Recognize the client's level of experience and expertise, and tailor training and communication accordingly • Deliver solution to clients in a timely and appropriate manner • Act as a liaison between technical groups and users to coordinate delivery of service or product • Recognize proprietary information and respect clients' confidentiality	These competencies are emphasized in: • Introduction to business (GBUS 101) • Systems Analysis (IT 160) • Systems Design (IT 260) Some of the competencies are also covered or practiced in: • Professional Report Writing (ENG 270) • Internship I (GBUS 291) • Internship II (GBUS 292) Every course requiring students to work on projects where specifications need to be defined helps students practice many of these competencies.

Problem Solving– *Foundation Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to identify and use a wide range of techniques and tools to identify and solve technical problems • Demonstrate the ability to use appropriate communication techniques to correctly isolate and identify a wide range of problems, and communicate resolution plans and/or solutions	*Demonstrate the ability to:* • Recognize a wide range of problems, and assess their impact on the system • Use a wide range of troubleshooting methods and tools to isolate problems • Select the appropriate approach to identify causes of the problem based on the given situation • Perform systematic analysis to identify problem causes using the best available tools and processes • Listen for input and ask critical questions to identify the problem and its possible causes • Identify, develop and test potential solutions, and develop resolution plan • Identify the potential risks in implementation, assess the cost/benefit of implementation alternatives (including non-implementation), and make recommendations • Communicate and implement solution in a manner that minimizes risk and disruption to productivity • Document and communicate problem, analysis and resolution process, solution and outcome • Develop recommendations for prevention of problem recurrence • Evaluate effectiveness of processes, tools and communication used in problem resolution and develop recommendations for continuous improvement	These competencies are emphasized in all the courses requiring students to work on projects, problems or activities, whether they are technical or non-technical.

Professional Development/ Self Learning– *Foundation Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
- Demonstrate the ability to identify and close gaps between one's knowledge and skills and those required by the situation - Demonstrate the ability to evaluate one's strengths and build upon them - Demonstrate the ability to identify sources of learning/training most appropriate for the subject and for one's personal learning style	*Demonstrate the ability to:* - Describe different learning styles, and explain which learning strategies best apply to each style - Identify one's own learning style and most effective learning forums - Recognize what skills and knowledge are needed to work on a specific project or in a specific environment - Anticipate the needs for new skills and knowledge based on changes in responsibilities and/or technologies - Assess personal skills and knowledge against identified needs - Assess objectively one's strengths and current knowledge - Build upon one's strengths and current knowledge to develop new skills - Leverage team resources to further one's own skills and knowledge - Evaluate the portability of one's skills to new areas of application - Research and evaluate options for training and education - Evaluate effectiveness of specific training or education programs in the context of identified needs, and available time and resources - Take advantage of on-the-job or on-the-project self-learning opportunities	These competencies should be infused in all courses and emphasized through students' assessment exercises whenever possible. A good forum to practice these competencies should be the Internship I (GBUS 291) and Internship II (GBUS 292) courses.

Professional Environment– *Foundation Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate successful work environment-related attitudes and skills • Demonstrate the ability to establish and maintain professional relationships	*Demonstrate the ability to:* • Identify employer expectations regarding job performance and attitudes • Explain the basics of and rationale for work ethics • Exhibit appropriate work habits and attitudes • Discuss issues of confidentiality, and explore behaviors and procedures to support company's policies in data confidentiality • Take pride in one's work and assume responsibility for personal actions • Explain and work within the organization hierarchy and reporting procedures • Accept constructive criticism and exhibit continual growth based on feedback and performance evaluation • Make appropriate and timely decisions based on facts, legality, ethics, purpose and culture • Display a positive attitude, project a professional image, and foster a productive environment • Identify characteristics of effective leaders, and demonstrate initiative and leadership skills • Explain the need and benefits of maintaining a strong professional network • Recognize and effectively use opportunities and forums to establish professional relationships • Foster and develop successful professional relationships	These competencies should be infused in all courses and emphasized through students' assessment exercises whenever possible. A good forum to practice these competencies should be the Internship I (GBUS 291) and Internship II (GBUS 292) courses.

Project Management– *Foundation Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to explain the purpose of, and participate in all the phases of project management • Demonstrate the ability to use appropriate project management planning tools and methods	*Demonstrate the ability to:* • Present the main steps and issues in project management • Evaluate project requirements, and clearly define and articulate project scope and goals • Identify stakeholders, decision-makers and escalation procedures • Develop detailed task list and analyze relationships between separate tasks and the overall project • Develop general project flow chart, identifying critical tasks and task interdependencies • Identify project time, personnel, budget and equipment requirements • Map resource requirements to resource availability, secure necessary resources and use resources effectively • Identify, evaluate and monitor risks throughout the project, and prepare contingency plans • Identify critical milestones and project performance, budgets and the use of resources • Identify a critical path failure, and implement contingency plans when necessary • Participate in and actively contribute to project reviews • Document and report project status in a timely manner using appropriate channels • Work effectively within the system and with members of the team and organization	These competencies are emphasized in: • Systems Analysis (IT 160) • Systems Design (IT 260) • Internship I (GBUS 291) • Internship II (GBUS 292) Every course requiring students to work in teams or individually on projects helps students practice many of these competencies

Proposal Writing– *Foundation Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to explain the necessary elements of a proposal and their respective purpose • Demonstrate the ability to develop a proposal that meets the client's requirements and effectively presents the phases of the project	*Demonstrate the ability to:* • Explain the proposal development process • Identify the key parts of a proposal and what contributes to an effective proposal • Develop an effective outline for a proposal • Develop concepts for the project and analyze effectiveness of each concept • Effectively present and justify selected concepts • Summarize relevant background and research material to support proposal • Develop a realistic estimate for budget, schedule and resources • Clearly present the different phases of the project and their interdependencies • Identify risks and present contingencies • Present the overall proposal in a level of details that meets the needs of the audience • Negotiate elements of the proposed work with clients and project team, and refine proposal accordingly	These competencies are emphasized in: • Systems Analysis (IT 160) • Systems Design (IT 260) • Professional Report Writing (ENGL 270) • Internship I (GBUS 291) • Internship II (GBUS 292) Every course requiring students to work in teams or individually on projects helps students practice many of these competencies.

Task Management– *Foundation Learning Component*		
Learner Program Outcomes	**Key Competencies** *Demonstrate the ability to:*	**Course Map**
- Demonstrate the ability to organize multiple tasks in the most effective way and allocate time and energy according to task complexity and priority - Demonstrate the ability to evaluate task outcomes and continuously improve organization process	- Break down projects and activities into a series of tasks - Identify task priorities and interdependencies, and organize in a logical sequence - Estimate time and resources necessary to complete specific tasks - Develop realistic schedule and effective work processes to accomplish assigned tasks - Recognize and resolve conflicts in the use of resources or in goals between separate tasks - Secure or request resources in a timely manner to accomplish tasks according to schedule - Conduct effectively, and monitor several tasks simultaneously - Monitor and evaluate tasks performance and completion against project plan and standards - Make process improvements and adjustments as tasks progress - Evaluate the impact of one's work on the rest of the project and team - Generate and communicate task status reports to peers and managers in the appropriate time and level of detail	These competencies should be infused in all the courses. Students practice most of these competencies through in-class and homework activities.

Team Work– *Foundation Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
- Demonstrate the ability to work collaboratively in a team setting - Demonstrate the ability to work and communicate effectively with people of different backgrounds and expertise in a group environment - Demonstrate the ability to recognize expertise in others, and to learn from others	*Demonstrate the ability to:* - Explain different team processes, roles and group dynamics, their purposes, advantages and disadvantages - Use effectively a variety of listening, communication and interactive styles and strategies, and recognize their appropriateness depending on the team environment and goals - Respect and work collaboratively with differences in backgrounds, opinions and communication styles - Recognize and respect cultural, ethnic and linguistic diversity - Recognize and leverage strengths in one's self and others to further the goals of the team - Foster an environment that supports risk taking in freely disclosing ideas and opinions - Identify and support productive ideas and processes that contribute to the goals of the team - Function effectively in different roles within the team, and show flexibility in accepting others' leadership - Manage conflicts in a productive manner, and work collaboratively to set and accomplish team goals - Learn from and teach other members of the team	**Course Map** Every course that requires students to work in teams emphasizes the practice of these competencies.

User Validation– *Foundation Learning Component*		
Learner Program Outcomes	**Key Competencies**	**Course Map**
• Demonstrate the ability to develop and implement an effective testing program that supports all phases of the development process	*Demonstrate the ability to:* • Develop a usability test plan that meets the goals and scope of the project, and company policies • Design specific usability tests to measure critical elements of the project at critical times in the project • Define the target audience, the feedback process, the testing procedure and the test sample population for each series of tests • Plan and coordinate customer acceptance testing • Select and apply efficiently appropriate usability testing tools and techniques • Conduct usability tests in the most efficient way • Analyze and document test results in a complete and unbiased manner • Summarize test results and draw appropriate recommendations • Implement changes based on test results, and communicate results and recommendations to appropriate team members and clients • Evaluate the effectiveness of the testing plan and procedures on a continuous basis • Assess overall product effectiveness and performances, and perform summative evaluation	Every course requiring students to work on projects developing applications should emphasize these competencies.