Computer Science Program Course Description

B.SC Requirement in CS

Course Descriptions

9102120—Calculus I (3 Credit Hours)

Limits and continuity: rates of change and limits, limits involving infinity, continuity, tangent lines. Derivatives: the derivative as a function and as a rate of change, derivatives of products, quotients and negative powers, derivatives of trigonometric functions, the chain rule, implicit differentiation and related rates. Application of Derivatives: extreme values of functions, the mean value theorem and differential equations, curve sketching. Integration: Anti-derivatives, integral rules and integration by substitution, Riemann sums and definite integrals, substitution in definite integrals, the mean value and fundamental theorems of calculus. Application of Integrals: volumes by slicing and rotation about an axis, modeling volume using cylindrical shells, lengths of plane curves.

9102131—Statistics & Experimental Methods (3 Credit Hours)

Descriptive statistics, probability and random variables, point and interval estimation, hypothesis testing, sample size determination, contingency table analysis, basic experimental design and analysis of variance, simple linear regression. Use of statistical software on business datasets. This course provides an introduction to basic methods of business research and the use of statistics to interpret business data. Students participate in several experiments and prepare written reports. Topics include experimental design, data collection and analysis, and communication of results. Also, problems and concerns in obtaining measurements; tabular and graphical organization of data to minimize misinformation and maximize information; and development and evaluation of models.

9112101—Introduction to Computer Science (4 Credit Hours)

This course provides a comprehensive introduction to computer science. Topics include numbering systems and conversion between them, data and memory representations, programming languages, machine language, assembly language, high level languages, compilation and interpretation, basic problem solving skills, overview of algorithms analysis and design. Experimental problems use Web-based tools, enabling students to learn programming fundamentals by developing their own interactive Web pages with HTML and JavaScript including data types, variables, expressions, Input/Output, control structures, and arrays. World Wide Web and HTML basics are introduced.

9112102—Fundamentals of Programming (4 Credit Hours)

This course offers a comprehensive introduction to programming and problem solving skills. Students will learn to write correct, reusable programs. The course introduces the Object-Oriented Design and Programming skills via the Java programming language. Program quality testing and analysis techniques are considered. The following concepts are introduced: decision trees, if-else branching, logical and mathematical expressions, assignments, strings and string manipulation, numerical computations, iterations and loop design, functions, parameter passing and method invocation, Input/Output, larger problems, data and scope, Recursion, graphics classes.

9112103—Introduction to Management (3 Credit Hours)

Management principles. The need for management, its relation to other sciences, study of its elements, main management schools; classical, behavior, and modern. Management's scientific and administration elements from planning, organization, steering, and monitoring.

9112201—Data Structure and Algorithms I (4 Credit Hours)

This course introduces the elementary data structures, abstract thinking in problem solving and Java implementations, software development concepts of encapsulation and information hiding, Abstract Data Types (ADTs). The course covers the following ADTs/Data Structures and their relevant algorithms: lists, linked lists, doubly linked lists, stacks, queues, double-ended queues, vectors, sequences, trees, dictionaries, and hash tables.

9112204—Introduction to Human Computer Interaction (3 Credit Hours)

An introduction to the current theories, methods, and issues in Human-Computer interaction. Theory and research along with practical application are discussed within the context of organizational impact. The course provides the knowledge of HCI systems and research used for the implementation of safe, quick, and useable interactive technologies.

9112301—Data Structure and Algorithms II (4 Credit Hours)

This course is a continuation of (9112201) and puts more emphasis on algorithms. Topics include: Time complexity and analysis tools, general analysis methodology, mathematical review, logarithms and exponents, primitive operations, average-case and worst-case analysis; the "big-O" and "little-O" notations. Sorting algorithms: merge sort, quick sort, bucket-sort, and radix-sort. Text processing, string operations, pattern matching algorithms. Text compression, the Huffman coding algorithm. The greedy method, graphs and graph algorithms: graph traversals, depth-first search and breadth-first search, shortest paths, Dijkstra's algorithm, minimum spanning trees, and Kruskal's algorithm.

9112221— Discrete Mathematics (3 Credit Hours)

This course provides an introduction to counting principles, properties of integers, principle of inclusion and exclusion, generating functions, recurrence relations, sets and enumeration, graph theory, algebraic structures with applications in computing.

9112232— Computer Organization & Architecture (3 Credit Hours)

This course provides an introduction to the design of the digital computer. Topics include number systems, digital logic gates, Boolean Algebra, design and implementation of combinational and sequential circuits, decoders, encoders, multiplexes, flip-flops, counters, registers and memory devices. The student is also introduced to the basics of computer organization and low level programming using Assembly language. The course examines the Computer hardware and figures out how it works from the inside-out. Topics include: Computer functions, Central Processing Unit's Organization, the Instruction Set, Bus interconnections, Cache Memory, Internal Memory, External Memory, Input/Output. Assembly language will focus on the Intel x86.

9112354— Software Engineering I (4 Credit Hours)

This course introduces software engineering as a discipline, discusses stages of the software life cycle, and compares development models such as waterfall, prototyping and

incremental/iterative models. Covers requirements analysis, effort and cost estimation, compares structured and object-oriented analysis and design methods. It also discusses verification/validation, quality assurance, software reliability, testing methods, maintenance, documentation, project management and team structure, metrics, and available tools.

9112351— Database Systems I (4 Credit Hours)

This course introduces concepts of relational database design and theories, entity-relationship and relational model, relational algebra, normalizations, query language SQL, storage and file structures, query processing, system architectures.

9112371— Computer Operating Systems (3 Credit Hours)

This course introduces the principles and evolution of Operating Systems. Topics include: process and processor management, concurrent processes and threads, memory management, primary and secondary storage management, Input/Output, and case studies of modern operating systems.

9112373— Computer Networks (3 Credit Hours)

Principles, design, implementation, and performance of computer networks and electronic data transfer. Topics include: Internet protocols and routing, local area networks, TCP, performance analysis, congestion control, switching and routing, mobile IP, peer-to-peer overlay networks, network security, and other current research topics. Programming assignments will be on protocol implementation and analysis.

9112381—Web Design and Programming (3 Credit Hours)

This course provides an introduction to Web development with focus on Client-Side programming. It includes designing with web standards, accessibility, usability, and site development and management. It covers all major aspects of web site design and programming including HTML, HTTP, CSS, JavaScript and Visual Basic Scripting as well as Java web programming. The course also includes advanced techniques in HTML programming (frames & style sheets) and concurrent programming for the web (multi-threading). The course also provides an introduction to server-side web programming.

9112364—Programming Languages Paradigms (3 Credit Hours)

This course is designed to provide a thorough introduction to the foundations and paradigms of programming languages. it will also investigate functional programming in

theory and practice and learn about some of the considerations underlying Java and object-oriented programming. Some of the topics to be covered are functional programming, logic programming, procedural programming, lambda-calculus, type systems, continuations, Java and the object-oriented paradigms.

9112491— Graduation Project/Seminar I (3 Credit Hours)

A seminar on advanced and current research topics in a Computer Science. Emphasis will be on participation and use of technical literature sources. A report document is expected at the end of the course.

9112492— Graduation Project/Seminar II (3 Credit Hours)

The course is a follow-up course to 9112491. The student is expected to implement and demonstrate the ideas explored in 9112491.

9112271— C and UNIX Systems Administration (3 Credit Hours)

This course teaches the management and administration of the UNIX operating system. Topics include: user accounts, controlling processes, disk and file systems, terminals, security configuration, startup and shutdown, backups, shells and shell programming, networking and package management.

9112352— Database Systems II (3 Credit Hours)

A continuation of 911351, this course is an advanced course in database systems that focuses on large database management systems based on the relational model. Topics include data modeling, normalization Theory, transaction management, distributed databases, concurrency control, and object-oriented databases.

9112362— Translators and Programming Languages (3 Credit Hours)

This course introduces the theories and foundation of high-level programming languages compilers/translators. Topics include an overview of the translation and compilation phases, contexts free grammars, syntax and directed translation, techniques used in lexical scanning, parsing and symbol table implementation, code generation and error diagnostic recovery.

9112281— Computer Graphics and Animation (4 Credit Hours)

This course offers an introduction to the principles, algorithms, and devices used in the construction and display of computer generated images. Topics include interactive graphics

techniques, vector, polygons and curve generations, colors and color schemes, 2D and 3D transformations, and animation.

9112321— Simulation Tools (4 Credit Hours)

This course offers an introduction to simulations and queue modeling. Topics include: random numbers generation, statistical sampling and analysis of data, simulation languages and selected applications. The course also covers the Monet Carlo Technique, using simulation languages, and the development of simulation models for specific problems.

9112386— Knowledge Base Systems (3 Credit Hours)

This course introduces the principles of knowledge base systems and their applications. Topics include: Knowledge, Knowledge representation, formal logic, database programming, and recursive programming. Selected language features including reels, arithmetic, type Predicates, meta-logic predicates, cuts, and negation are introduced with programming example. Theory and practice of knowledge-based system construction. The course also covers topics on inference engines, reasoning from incomplete or uncertain information, and user Interfaces.

9112374— Mobile Computing (3 Credit Hours)

This course covers topics on mobility management, Mobile IP, hand-off, routing, multicasting, and reliable communication in wireless networks. Data management, push-pull based data acquisition, issues in wireless mobile systems, resource allocation, QoS issues and multimedia transmission over wireless, WAP and bluetooth technologies, and third generation systems.

9112384— Bioinformatics (3 Credit Hours)

This course offers an introduction to the field of bioinformatics and genomics. Topics include theoretical and computational aspects of bioinformatics and their relevant real-life applications, a practical description of the topics, tools, issues and current trends in these and other related fields.

9112385— Parallel Programming (3 Credit Hours)

This course offers an introduction to concurrent and parallel programming, with emphasis on language constructs. Major topics include: exceptions, coroutines, atomic operations, critical sections, mutual exclusion, semaphores, high-level concurrency, deadlock,

inter-process communication, process structuring, shared memory and distributed architectures. Students will learn how to structure, implement and debug concurrent programs.

9112311—Creative Design for Information Technology (3 Credit Hours)

This course explores the fundamentals of design as they relate to the presentation and implementation of communication. Builds awareness of visual form and skills, including line, shape, contrast, color, composition, and the visual vocabulary used in concept development and the creative promotion of ideas. Students will investigate and solve basic visual and design problems. The course offers practical hands-on training using relevant design tools (e.g. Photoshop and In-Design).

9112302—Managing Information Technology Resources (3 Credit Hours)

This course provides an introduction to fundamental concepts of management and applies them to IT. It examines the use of IT in business processes and the management issues of integrating IT into organizational processes to gain competitive advantage. Topics, include: management, organizations and information systems; development life cycle; project management and systems engineering; process reengineering; and organizational learning.

9112355—Enterprise Information Architecture (3 Credit Hours)

The course focuses on the organization and development of the infrastructure necessary to support an enterprise information system for patient care. Components of the architecture are introduced in a problem-based approach and case examples are presented as the basis for addressing specific attributes of the components, as well as problems facing the design of an enterprise information system for health care.

9112340—Information Ethics (3 Credit Hours)

In today's world, information technology (IT) is evident in almost every aspect of life. It is difficult to imagine a workplace without computers, banking without ATM machines, or grocery stores without bar code readers at the checkout. While much attention has been focused on the use of these machines to revolutionize business, until recently there has been little discussion of the ethical dilemmas that, if not created by IT, are amplified by its use. It has been said that every new age requires a new set of moral and ethical values. Indeed, mankind has entered a new age with the computer/information revolution, and it is time to

review the ethical impact of this technology. This course attempts to address this need. The course will also address ethical and legal issues involved in electronic business.

9112387—Remote Sensing and GIS Systems (3 Credit Hours)

This course is offered in cooperation with the department of Earth and Environmental Science. Topics include: Aerial photography, land satellites, GIS applications and land use. Building GIS projects, building geo-databases and spatial analysis, converting form vector to raster model, using the GIS tools for environmental analysis and applications. The course also offers hands-on training on the ArcGIS software group.

9112365—Systems Implementation and Testing (3 Credit Hours)

In this course, students will explore and become familiar with the various concepts, principles, and stages of computer-based information systems analysis, design, and testing. Students will be exposed to and learn about the different methods, tools, and techniques used in structured systems analysis and design. Feasibility studies, requirements analysis, and structured design methods will be taught. In addition, system development approaches, documentation, implementation, verification, validation, and testing will be covered. The system development life cycle concept, prototyping, data modeling, and the role of user involvement will also be covered.

9112358—Introduction to Artificial Intelligence (3 Credit Hours)

This course introduces the basics of artificial intelligence and the science of building autonomous agents that exhibit intelligent behavior. The course discusses problems in game playing, natural language processing, computer vision, and robotics. These problems are challenging due to the inherent noise/uncertainty and computational complexity. This course provides the mathematical and algorithmic framework for tackling these sorts of problems. Topics include search, decision theory, graphical models, machine learning, and various applications.

9112376—Distributed Systems (3 Credit Hours)

This course introduces the principles and concepts for designing distributed systems and experience of software platforms which underpin their development. Topics include: characterization of distributed systems, system models, protocols and inter-process communication, synchronization (time and global state), coordination, agreement and

scheduling, distributed objects, RPC, RMI, security, naming and name servers, distributed file systems. The course also includes some examples of current distributed systems like (Mach, Amoeba, OSF DCE, SOAP, CORBA, DCOM. and .NET) and other current topics.

9112366—Software Quality Control (3 Credit Hours)

This course introduces the principles and techniques computer software Quality Control and testing. Topics include: acceptance testing, integration testing, module testing, writing stubs, verification and validation, statistical techniques, defect tracking, causality analysis, reviews, walkthroughs, and exception handling.

9112348—Management Information Systems (3 Credit Hours)

This course introduces the concepts of Management Information Systems (MIS). Topics include: the structure of an MIS, organizing the data processing activity, office automation, the decision making process, information systems plan, and project management. It also covers specialized concepts of Computer-Center Management (CCM).

9112360—Genetic Algorithms and Programming

This course introduces machine learning which represents the study of computer algorithms that improve automatically through 'experience'. Genetic algorithms & programming is a biologically motivated method for manipulating a "population" of algorithms such that they improve as they experience an environment. The Genetic Programming approach, however, is but one of a family of search methods, referred to as Evolutionary Computation. This course focuses on Genetic Algorithms and Genetic Programming alone with the basic objective of providing a thorough grounding in this family.