COURSE CATALOG

CS Bachelor Program

ABET | Computing Accreditation Commission

CPCS-201 Introduction to Computer Science (3 Credits)

The objective of this course is to provide an introduction to the computer science discipline. Topics include the representation and manipulation of data in computers, description of computer hardware components and how the work, and an overview of operating systems, algorithms, and programming languages.

CPCS-202 Programming (I) (3 Credits)

The objective of this course is to cover the fundamental concepts of procedural programming. This course introduces the Java programming language and helps students develop basic problem-solving skills. Topics include algorithms, flowchart, API, IDE, and JDK, numerical data, primitive data type, short hand operators , cast value of one type to another type , selection statements, switch statements, break and continue statements, relational operators, logical operators, logical expressions, Boolean variable, Boolean expressions, repetition statements, nested loops, methods, pass arguments to a method, method overloading, method abstraction, use of methods in the math class, arrays, common array operations, methods with array arguments and return value, search and sort operations on array.

CPCS-203 Programming (II) (3 Credits)

The objective of this course is to cover the basic and intermediate concepts of object oriented programming. Topics include the use of numerical data, primitive data types, selection statements, repetition statements, class, standard classes, object, instance of a class, object oriented programming, software development, constructor, methods, call by values, call by reference, UML, state memory diagram, class diagram, arrays, method overloading, constructor overloading, overriding, this, new, exception and assertions, Inheritance, encapsulation, data abstraction, private, public, protected, exception, inheritance, abstract class, polymorphism, file handling.

PREREQ: CPCS-202

CPCS-204 Data Structures (I) (3 Credits)

The objective of this course is to provide students an understanding of abstract data structures, including, but not limited to, arrays, linked lists, queues, stacks, trees, and graphs. The course also aims to give a conceptual understanding of the trade-offs between various data structures, hence enabling students to choose an optimal data structure for a particular application. The students will also learn concepts of algorithmic design, recursion, and a variety of searching and sorting algorithms.

PREREQ: CPCS-203

CPCS-211 Digital Logic Design (3 Credits)

This objective of this course is to provide an introduction to the fundamental concepts of digital logic design. Topics include number systems, binary codes, Boolean algebra, canonical and fundamental forms of Boolean functions, functions applications to digital circuits design, minimization of Boolean functions by Boolean algebra and Karnaugh maps, two -level and multi-level digital circuits, decoders, encoders, multiplexers, demultiplexers, latches, flip-flops, registers, counters, analysis and synthesis of synchronous sequential circuits. Additionally, this course includes a laboratory component in which students apply the design principles learned in lectures to the design of combinational circuits and synchronous sequential circuits.

PREREQ: CPIT-201

CPCS-212 Applied Math for Computing (I) (4 Credits)

The objective of this course is to familiarize students with the basic concepts of applied mathematics used in computer science. Topics include: Matlab: matrices and arrays, Matlab: graphics, Matlab: programming, solution of nonlinear equations, solution of systems of linear equations, numerical integration, numerical differentiation, and ordinary differential equations.

PREREQ: MATH-202

CPCS-214 Computer Organization and Architecture (I) (3 Credits)

The objective of this course is to explain how computers are designed and how they work. Students are introduced to modern computer principles using a typical processor. They learn how efficient memory systems are designed to work closely with the processor, and how input/output (I/O) systems bring the processor and memory together with a wide range of devices. The course emphasizes system-level issues and understanding program performance. Topics include instructions sets, assembly language, internal data representation, computer arithmetic, processor data path and control, memory hierarchy, I/O devices and interconnects, and an introduction to parallel processing.

PREREQ: CPCS-211

CPCS-222 Discrete Structures (I) (3 Credits)

The objective of this course is to study the logical and algebraic relationships between discrete objects. This course cultivates clear thinking and creative problem solving by developing students' mathematical maturity in several core areas: logic and proofs, sets, functions, relations, and counting techniques.

CPCS-223 Analysis and Design of Algorithms (3 Credits)

This is the first of a two-course sequence on computer-based algorithmic solution design and advanced data structures. It introduces fundamental algorithms for classic computing problems, the techniques used to construct them, their performance and applications. Topics include: formal definition and characterization of algorithms, recurrence relations, asymptotic notation and efficiency classes, iterative and recursive algorithm efficiency, empirical analysis of performance, advanced data structures such as balanced trees, and the design techniques: brute force, divide-conquer, decrease-conquer, problem transformation, and trading space for time.

PREREQ: CPCS-204

CPCS-241 Database (I) (3 Credits)

This objective of this course is to introduce students to database management systems. Topics include Data, Information, File System, Database and Database Users, Database System Concepts and Architecture, Data Modeling using the Entity Relationship (ER) Model, The Relational Data Model and Relational Database Constraints, Functional Dependencies and Normalization for Relational Databases, The Relational Algebra and Relational Calculus, Relational Database Design by ER and EER to Relational Mapping, Disk Storage, Basic File Structure and Hashing, SQL-99 Schema Definition, Constraints, Queries and Views (DDL and DML).

PREREQ: CPCS-204

CPCS-301 Programming Languages (3 Credits)

The objective of this course is to provide a comprehensive coverage of the fundamental concepts of programming languages by discussing the design issues of the various languages constructs, examining the design choices for these constructs in some of the most common languages, and critically comparing design alternatives. It discusses the formal methods of describing the syntax and semantics of programming languages.

PREREQ: CPCS-204, CPCS-222

CPCS-302 Compiler Construction (3 Credits)

The objective of this course is to acquaint students with the fundamentals of compilers and their construction. The course considers the principles that underlie compiler construction and focuses on the translation of programs written in conventional, higher level language into semantically equivalent programs written in assembly language. Students will learn how modern programming languages are implemented, how compilers interact with operating systems and machine architecture, and how to use compiler construction tools.

PREREQ: CPCS-301

CPCS-323 Summer (workplace) Training (0 Credit)

This is mandatory, 200-hour internship program for all FCIT students. The objective of this course is to provide students the opportunity to apply their academic education with hands-on, real world experience in a work setting. Students are sent to different companies to get the real flavor of work groups, communications, and professional development experiences.

CPCS-324 Algorithms and Data Structures (II) (3 Credits)

This is the second of a two-course sequence on algorithmic solution design and advanced data structures. The objective of this course is to study algorithms from a major application area, to illustrate advanced design techniques, and to introduce main concepts in computational complexity. The course should provide an opportunity to work with complex data structures and develop advanced programming skills. It should include significant discussion of applications and capstone project ideas. Topics include space and time trade-off techniques, limitations of algorithm power, and algorithms that illustrate advanced design methods such as dynamic programming, iterative improvement and greedy techniques. Suggested application areas include: graphs, operations research, computational geometry, bioinformatics, and cryptography.

PREREQ: CPCS-222, CPCS-223

CPCS-331 Artificial Intelligence (I) (3 Credits)

The objective of this course is to provide a broad overview of AI and building intelligent systems. Topics include intelligent agents, problem-solving as a search activity, knowledge representation, planning, reasoning and learning. Students will also be introduced to evolutionary computation (EC), natural language processing (NLP), and programming in Prolog.

PREREQ: CPCS-204, CPCS-223

CPCS-351 Software Engineering (I) (3 Credits)

The objective of this course to introduce students to the basic concepts of software engineering as they relate to the development of medium to large scale software systems. Topics include the software life cycle, requirements development, object orientation, software architecture & design, and software testing. Students are expected to learn how to apply such principles to a real world problem. A term project of a medium-size is required.

PREREQ: CPCS-204

CPCS-353 Software Engineering Practice (3 Credits)

The objective of this course is to further explore the design and thinking of object-oriented software engineering, from analysis through testing. Topics include practices of software project management, project estimation, distributed system architectures (client/ server), distributed object model, building client/server applications based-on Object-oriented technology, and Object-Oriented software engineering approach. The course will also teach students the principles and practices of software testing, validation, verification, maintenance, writing documentation, and evaluation of systems and tools.

PREREQ: CPCS-351

CPCS-361 Operating Systems (I) (3 Credits)

The objective of this course is to provide a general overview of operating systems concepts and recent methodologies and techniques used in the field and their trades-offs, with various examples from the contemporary used systems. Topics include the basic structure of an operating system, its interaction with the hardware, software, and users, and the services it provides. The course illustrates different algorithms and techniques used in controlling, managing, and allocating various computer resources, such as CPU, memory, storage and I/O devices. It demonstrates the tuning of the operating system for maximizing the utilization and increasing the performance of the computer system.

PREREQ: CPCS-204, CPCS-214

CPCS-371 Computer Networks (I) (3 Credits)

The objective of this course is to provide an introduction to computer networks and the ISO-7 layers reference model, which includes necessary protocols. Selected network layers, such as data link layer, transport layer, network layer, etc., will be focused on with detailed information. In addition to this, network security, web technologies and application layer will also be introduced.

PREREQ: CPCS-214

CPCS-372 Computer Networks (II) (3 Credits)

The objective of this course is to introduce students to the principles, design, implementation, and performance of computer networks. This course is based on the layering architecture and covers the routing protocols in detail. Topics include Internet routing protocols, local area networks, congestion control, TCP, wireless communications and networking, mobile IP, performance analysis, network address translation, multimedia over IP, switching and routing, peer-to-peer networking, network security, and other current research topics in the area of computer networks.

PREREQ: CPCS-371

CPCS-381 Human-Computer Interaction (2 Credits)

The objective of this course is to familiarize students with the skills and concepts of Human-Computer Interaction (HCI), including the understanding of user needs, interface design and prototyping, and interface evaluation. Topics include an introduction to HCI, HCI goals, cognitive and perceptual issues, HCI design, data gathering, data analysis, task description, task analysis, interaction styles, interaction frameworks, prototyping, and evaluation.

PREREQ: CPCS-204

CPCS-391 Computer Graphics (I) (3 Credits)

The objective of this course is to study the hardware and software principles of interactive raster graphics. Topics include an introduction to the basic concepts of computer graphics, 2-D and 3-D modeling and transformations, viewing transformations, projections, rendering techniques, graphical software packages, and graphics systems. Students will use a standard computer graphics API to reinforce concepts and study fundamental computer graphics algorithms.

PREREQ: CPCS-204, CPCS-212

CPCS-403 Internet Application Programming (3 Credits)

The objective of this course is to provide a broad overview of Internet and Web technologies. Topics include HTML, XHTML, CSS, client-side scripting (JavaScript), server-side scripting (PHP), Web database connectivity, and XML Technologies. The students will be encouraged to design, implement, and evaluate small-scaled Web projects in groups/teams.

PREREQ: CPCS-324, CPCS-371

CPCS-404 Component-Based Computing (3 Credits)

The objective of this course is to familiarize students with Component-Based Computing. Topics include component fundamentals, rationale of using component-based computing, and their standard criteria. The course also focuses on recent researches and techniques related to component-based computing. Moreover, it covers issues related to the component-based technology, the various tools of component-based computing, and the future of component-based computing.

PREREQ: CPCS-351

CPCS-405 Software Technology Topics (3 Credits)

The objective of this course is to explore recent topics related to Software Technology. Topics include Object-Oriented Programming fundamental concepts, advanced swing graphical user interface, advanced exception Handling Techniques, Streams and Files, multithreading programming, and networking programming. Moreover, the course also focuses on database programming (JDBC), servlets and java server pages (JSP), and Java Security.

PREREQ: CPCS-351

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CPCS-413 Computer Architecture (II) (3 Credits)

The objective of this course is to explore modern computer architecture approaches, such as designing advanced computer instructions, parallelism, and the advanced methods of data processing.

PREREQ: CPCS-214

CPCS-414 High Performance Computing (3 Credits)

The objective of this course is to provide an in-depth overview of the current state of the art in high-performance computing. Additionally, the course provides more information about the architecture of high-performance computers.

PREREQ: CPCS-361

CPCS-424 Theory Of Computation (3 Credits)

The objective of this course is to introduce students, with a background in Sciences, Engineering, or Mathematics, to some of the basic principles pertaining to the modeling and analysis of computational problems and their solutions.

PREREQ: CPCS-212, CPCS-222

CPCS-425 Information Security (3 Credits)

The objective of this course is to provide an introduction to information security in computer networks, with a focus on providing basic knowledge of the technical and operational issues of modern cryptosystems and their related standards. Topics include security threats and vulnerabilities, classical encryption techniques, block ciphers and stream ciphers, DES and triple DES, AES, Block cipher operation modes, asymmetric ciphers: RSA, Diffie-Hellman key exchange, hash functions, MAC functions, digital signature: digital Signature Standard DSS, key management and distribution, X.509 certificates, web security: SSL and TLS, email security (PGP), malicious software, and firewalls.

PREREQ: CPCS-361, CPCS-371

CPCS-432 Artificial Intelligence (II) (3 Credits)

The objective of this course is to explore advanced topics concerning Artificial Intelligence and to cover programming language related to AI.

PREREQ: CPCS-331

CPCS-433 Artificial Intelligence Topics (3 Credits)

The objective of this course is to explore recent topics related to Artificial Intelligence and the latest advances in this field.

PREREQ: CPCS-331

CPCS-442 Database (II) (3 Credits)

The objective of this course is to explore advanced topics in databases, with a focus on distributed and parallel database management systems followed by database design and implementation. Topics include performance optimization, database security, transaction processing, data warehouses, and data mining.

PREREQ: CPCS-241

CPCS-454 Object-Oriented Analysis and Design (3 Credits)

The objective of this course is to familiarize students with the fundamental foundations of Object-Oriented Approach in relation to systems and the advantages of this method. This course covers understanding various approaches and methodologies used in different phases of software development lifecycle, including requirements, analysis and specification, software design, software construction, software maintenance, and software process.

PREREQ: CPCS-351

CPCS-457 Software Engineering Theory (3 Credits)

The objective of this course is to study the methods, values, attitudes, and techniques in software systems. It provides an understanding of the need for rigour and enables students to select and apply a relevant methodological approach to the development of well-designed and documented systems.

PREREQ: CPCS-351

CPCS-462 Operating Systems (II) (3 Credits)

The objective of this course is to familiarize students with the modern alternative operating models such as distributed processing, parallel processing, and real-time processing. Topics include virtual memory, thread scheduling, security systems and their requirements, shared security systems, performance quality, system reliability, system failure, prefailure warning, and system recovery.

PREREQ: CPCS-361

CPCS-463 Computing Systems Security (3 Credits)

The objective of this course is to introduce the fundamentals of Computer Security Systems and the potential risks and vulnerabilities in these therein. Topics include security management practices, access control systems and methodology, networks and Internet security, enterprise security architecture, operations security law, investigation, and ethics.

PREREQ: CPCS-361, CPCS-371

CPCS-464 Dependable Computing (3 Credits)

The objective of this course is to acquaint students with the high-reliability computer systems used in fault intolerant critical applications. Topics include computing systems security, applications that require high-quality computer systems, mobile client system, various security protocols, multi-distribution system, breach discovery and prevention, wireless networks reliability measurement, and ensuring the quality of service.

PREREQ: CPCS-463

CPCS-465 Performance and Modeling of Computing Systems (3 Credits)

This objective of this course is to familiarize students with the fundamentals of performance and computer systems modeling, introducing students to computer systems and their components (hardware and software). This course also covers different methods of performance measurement, algorithms of software performance measurement, and computer performance measurement.

PREREQ: CPCS-324, CPCS-361

CPCS-466 Systems Programming (3 Credits)

The objective of this course is to explore the design, development, and operation of system applications. Topics include the difference between system software and application software in terms of development features and area of application, file systems, permanent and temporary storage systems, assembly compiler, high-level languages, application setup, memory management system, and processes carried out under the operating systems.

PREREQ: CPCS-361

CPCS-473 Computer Networks Practice (3 Credits)

The objective of this course is to explore topics related to the practical aspects of networks, thereby familiarizing students with the various network components. The course provides an understanding of the network design and analysis as well as network architecture, including requirements validation and traceability. Students will be introduced to analyzing, developing, and validating requirements regarding the network architecture, in addition to network management principles and performance evaluation.

PREREQ: CPCS-371

CPCS-474 TCP/IP and Web Networking (3 Credits)

The objective of this course is to study the fundamentals of TCP/IP networks, technologies, and the Web. Topics include HTTP protocols, Web protocols, TCP/IP networks, Web services and standards.

PREREQ: CPCS-371

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CPCS-482 Multimedia and User Interface Design (3 Credits)

The objective of this course is to explore the fundamentals of multimedia and the use of multimedia in user interface design. The course is intended to give students both a theoretical understanding of, and practical experience with, designing multimedia products and the user interface design.

PREREQ: CPCS-381

CPCS-494 Special/Selected Topics (3 Credits)

The objective of this course is to explore selected topics about the latest advancements in the field of Computer Science (topics determined by the Council of the Computer Science Department).

CPCS-498 Senior Project (I) (1 Credit)

This course is the first part of a sequence of two courses that constitute the BSc graduation capstone project. In this part, the student is expected to propose, analyze, and design a software system or conduct a thorough investigation of a particular CS-related problem for research-based projects. The student will deliver oral presentations and written reports.

CPCS-499 Senior Project (II) (3 Credits)

This course is the second part of a sequence of two courses that constitute the BSc graduation capstone project. In this project, the student will continue the System/Research development of the project that started in CPCS-498. The student will deliver oral presentations, progress reports, and a final report.

PREREQ: CPCS-498