Computer Science Department

VISION AND MISSION

The Vision of Computer Science department is to be recognize locally and regionally as a leading department providing high quality education, researches and services.

The Mission is to upgrade human capacity in all areas of computer Science, using modern scientific methods, while contributing to the community service and the competencies required to contribute to the advancement of scientific research.

ENTRANCE REQUIREMENTS

A student interested in joining the Faculty of Computer and Health Informatics, has to:

1. Obtain pass mark in in seven subjects including: Arabic language, religious studies, English language, mathematics, physics, chemistry and biology or computer sciences or engineering sciences. International students who have not studied Arabic and religious studies may have alternative subjects from an approved list of subjects published in the webpage of Ministry of Education.
2. Achieve the percentage in Sudan School Certificate announced every year (International may have 10% less in the School Certificate scores.
3. Apply electronically though the website of the Admission and Accreditation Office, Ministry of Education, or apply directly in Admission Office in the National University, and pass the health examination, aptitude tests and interview at the Faculty of Computer and Health Informatics.
4. Pay the published fees:15,000 SDG or US $ 3000 [international students]

CAREER ADVICE

This program prepares graduates possess practical knowledge of the foundations of the theory and application capabilities in the analysis, design and implementation of the required questions solutions to improve the performance of organizations. Therefore, the job opportunities will be available for graduates of this program in many areas, including:

- Working with software companies.
- Telecommunications sectors.
- Banks and financial organizations.
- Academic and educational institutions.
- Governmental organizations.

COMPUTER SCIENCE DEPARTMENT OBJECTIVES

The objectives of the department of Computer Science are to:

1. Emphasize values and ethical heritage of the Sudanese Nation in its curriculum, and follow strategies that lead to strengthening these values, as an important component of the National University philosophy and message.

2. To provide the necessary workers to bring about a renaissance of computer technology in the country.

3. To localize of knowledge in the field of computer science in the country.

4. To build the computer society.

5. To develop algorithms for the software solutions to solve the problems of national organizations.

6. To provide community service based on conducting scientific studies and applied research in the areas of Computer Science that have a direct impact on development in the community.

7. Strengthen computer science research, making use of the University's accessibility and communication privileges.

Curriculum Objectives

[Characteristics of the Computer Science graduate

A graduate of the National University Computer Science Curriculum should be able to:

1. Adopt the strategies of the National University-Sudan and abide by its objectives and rules stated in its charter.
2. Integrate his/her background knowledge in business management, information systems, computer science and health care and using it effectively in any position in Information systems in the health industry and organization.
3. Improve and develop the organization.
4. Exploit the opportunities provided by technical inventions in developing the business and organization.
5. Analyze a problem, and identify and define the computing requirements appropriate to its solution.
6. Design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.
7. Secure data and technical infrastructure of the organization.
8. Understand and manage the risks of using computer science applications in the organization.
9. Communicate effectively with a range of audiences
10. Work in a team.
11. Conduct scientific research in the field of computer science.

EDUCATIONAL STRATEGIES AND METHODS

Emphasis on learning strategies include: (1) Practice plan to purchase basic skills in Computer applications, communication and information technology in an organizations, (2) learning student-centered, and responsibility maximum in the learning process of students, and (3) based on problem-solving and learning-oriented problem, (4) community-oriented activities of the community and, (5) the integration of basic and community science and practice and training in communications companies (6) and self-peer teaching and

assessment, (7) the team approach, (8) and a wide range of optional, (9) continuous assessment, (10) preparation for continuing education.

Faculty of Computer Science and Information Technology adopt the following methods in the daily programme of activities: (1) (Sessions- learning) based on the solution of problems (2) Seminars and discussions small group (3) Practice in communications companies is essential part of the curriculum (4)Practicing in the computer laboratories is essential part of the curriculum (5) lectures (6) Educational activities, duties and reporting and research activities (according to the nature of the subject) (7) Elective courses

Introduction

The department provides a bachelor of Science in Computer Science (Honour) program (BSc. CS) , which requires four years (8 semesters).

Study Plan for the program include 169 credit hours Bachelor degree in Computer Science (Honor). Two semesters per academic year, 15-18 weeks length of each semester. This period does not include examinations that take place at the end of each semester. The program supports a continuous assessment system that may contain exams, practical applications, tutorials, seminars and tests.

The Plan includes research project for graduation of 6 credit hours.

The programme schedule therefore involves considerable commitment from students to be on time at the respective sites specified in their daily timetables. Each student should have a functioning e-mail address for last moment changes, a frequent incident in field training programmed

STRUCTURE OF COMUTER SCIENCE CURRICULUM

Semester 1 [21 CHs- 18 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Computer Applications	COM-111	Longit.	2	2	-	3
2	Principles of Information Systems	INF-112	Longit.	2	2	-	3
3	English for Specific Purpose (I)	HMS113	Longit.	2	2	-	3

4	Calculus (I)	MAT114	Longit.	2	2		3
5	Introduction to Computer Science	COM115	Longit.	-	2	3	3
6	Discrete Mathematics	MAT116	Longit.	2	2		3
7	Principles of Economic	HMS117	Longit.	2	2		3
			18	12	14	3	21

COURSE OUTLINE

Detailed behavioral objectives, skills, assignments and problems are listed in each course book. The lists are too extensive to be included below

Courses in the curriculum timetable not outlined below are included in other programmed, or in the original document with the program coordinator.

Title	*Code*	*Semester/Duration*	*Credits*
Calculus -1	MAT114	1/Longitudinal	3(2,2,0)

This introductory calculus course covers differentiation and integration of functions of one variable, with applications. Topics include: concepts of function, limits and continuity, differentiation rules, application to graphing, rates, approximations, and extremum problems, the fundamental theorem of calculus, applications to differentiation

Title	*Code*	*Semester/Duration*	*Credits*
Principles of Computer Science	COM115	1/Longitudinal	3(2,0,3)

The course provides students with a broad foundation in computer science. Topics include:
introduction to digital technology, historical review; logic gates; binary, octal, and hexadecimal systems; computer architecture and basic components, internal and external interfaces, types of removable media; introduction to operating systems; programming paradigms, basic programming concepts; concept of algorithm, representation, correctness and performance of algorithms; introduction to objects. The course equips students with basic problem solving skills and prepares them for taking the programming sequence subjects and other computer science disciplines.

Title	*Code*	*Semester/Duration*	*Credits*
Discrete Mathematics	MAT116	1/Longitudinal	3(2,2,0)

Propositional logic, predicate logic and quantification, methods of proof, sets and functions, arithmetic algorithms, growth of functions, computational complexity of algorithms, integer properties and matrices, mathematical induction, recursion, sequences and summations, program correctness, graphs and its applications, trees and its applications, languages and grammars, finite-state machines, automata and language recognition, turing machines

Title	*Code*	*Semester/Duration*	*Credits*
Principles of Economics	HMS117	1/Longitudinal	3(3,0,0)

The course topics: language of economics, types of economies and economic systems and institutions, the graph – tool of the economist: math review, production possibility frontiers – opportunity costs and efficiency, the market economy – supply and demand consumer and producer surplus, elasticity of supply and demand, individual choice, the theory behind demand, theory of the firm, supply production and costs, perfect competition, monopoly, monopolistic competition, oligopoly, and strategic pricing, wage and interest determination, the government in the economy

Semester 2 [23 CHs- 18 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	File Management	COM121	Longit.	2	2	-	3
2	Introduction to Databases	COM122	Longit.	2	2	-	3
3	English for Specific Purpose (II)	HMS123	Longit.	2	2	-	3
4	Computer Maintenance	INF124	Longit.	2	-	-	2
5	Principles of Accounting	HMS125	Longit.	2	2	-	3
6	Principles of Programming	COM126	Longit.	2	0	3	3
7	Algebra and Geometry	MAT127	Longit.	2	2	-	3

8	Calculus (II)	MAT128	Longit.	2	2	-	3
			18	16	12	3	23

Title	***Code***	***Semester/Duration***	***Credits***
Principles of Accounting	HMS125	2/Longitudinal	3(2,2,0)

Course orientation: Overview of classroom policies and expectation, introduction to accounting and business, analyzing transactions, the Adjusting process, completing the accounting cycle, accounting for merchandising businesses, nature of merchandising business, financial statement s for a merchandising business, merchandising transactions, the Adjusting and closing process, the periodic inventory system, inventories, control of inventory, inventory cost flow assumptions, inventory costing methods, reporting merchandise inventory in the financial statements, estimating inventory cost, cash, bank reconciliation and petty cash.

Title	***Code***	***Semester/Duration***	***Credits***
Principles of Programming	COM126	2/Longitudinal	3(2,0,3)

Computer structure and algorithms (computer structure. low and high languages, compiling, running and debugging). The components of JAVA language (types in JAVA, variables, assignment and conditional statements). Loop statements (the for-statement, the while-statement, the do-while statement and casting). Arrays (arrays declaration , multidimensional arrays, class string and string methods.). Methods in Java (principles of procedural programming. top-down design of a program, modulation, passing parameters to method, static methods). Sorting and searching algorithms (selection sort, insertion sort, bubble sort, searching methods). Recursion 1 (recurrence as an alternative to iteration, different kinds of recursion). Recursion 2 (recursion and arrays, towers of Hanoi problem). Principles of Object-Oriented Programming(OOP) (class definition: attributes and methods, constructors (copy, default), setter and getter methods, references to object, encapsulation). Inheritance (creating subclasses, overriding methods, class hierarchies). Collections, composite objects, self referential objects. Dynamic data structures (stack,linked lists, two way linked list). Advanced Input /Output: streams and files (basic file manipulations in JAVA. Review (review on the whole material following above).

Title	*Code*	*Semester/Duration*	*Credits*
Linear Algebra and Geometry	MAT127	2/Longitudinal	3(2,2,0)

This course cover: Linear equations and matrices, vector spaces, linear transformations. Inner products, orthogonalisation and projections, QR factorizations, reactions. Determinants. Eigen values and eigenvectors. orthogonal transformations, symmetric matrices and quadratic forms, canonical forms for conics and quadrics, principal axes, diagonalisation of a quadratic form by completing the square and Sylvester's law of inertia. The Cayley-Hamilton Theorem, Jordan forms, functions of matrices, systems of ordinary differential equations.

Title	*Code*	*Semester/Duration*	*Credits*
Calculus-2	MAT128	2/Longitudinal	3(2,2,0)

This introductory calculus course covers integration of functions of one variable, with applications. Topics include: Concepts of integration, definite and indefinite integration, the fundamental theorem of calculus, applications to geometry: area, volume, and Arc length, applications to science: average values, work, and probability, techniques of integration, approximation of definite integrals, improper integrals, and l'hôspital's rule.

Semester 3 [24 CHs- 18 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Digital Systems	COM211	Longit.	2	2	-	3
2	Programming Methods (I)	COM212	Longit.	2	-	3	3

3	Differential Equations	MAT213	Longit.	2	2	-	3
4	Multimedia	INT214	Longit.	2	-	3	3
5	Database Concepts	COM215	Longit.	2	-	3	3
6	Statistics & Probabilities(I)	MAT216	Longit.	2	2	-	3
7	System Analysis & Design	SYS217	Longit.	2	2	-	3
8	Numeric Computation (I)	MAT218	Longit.	2	2	-	3
			18	16	10	9	24

Title	***Code***	***Semester/Duration***	***Credits***
Digital Systems	COM211	3/Longitudinal	3(2,2,0)

This course introduces students to the basic concepts of digital systems, including analysis and design. Both combinational and sequential logic will be covered. Students will gain experience with several levels of digital systems, from simple logic circuits to hardware description language and interface programming in C.

The following topics will be covered: number systems, boolean algebra, binary arithmetic, logic gates, programmable logic, combinational logic and building blocks, synchronous sequential circuit design, latches, flip-flops, registers and counters , state machines, verilog and C programming.

Title	***Code***	***Semester/Duration***	***Credits***
Programming Methods	COM212	3/Longitudinal	3(2,0,3)

Review of control structure, functions, and primitive data type, arrays , multi-dimensional arrays, more about methods, exceptions, recursion, classes & objects, inner classes. I/O techniques in java, file and other related classes(streams). strings, string processing and data representing in memory.

Title	***Code***	***Semester/Duration***	***Credits***
Differential Equations	MAT213	3/Longitudinal	3(2,2,0)

First-Order Differential Equations(ODE), separable equations & applications, linear equations and applications, second-order differential equations, introduction ,general solutions, homogeneous equations ,free mechanical vibrations ,non-homogeneous equations ,forced mechanical vibrations ,the Laplace transform, Laplace transform and its inverse, transforms of derivatives, shifting theorems , discontinuous inputs.

Title	*Code*	*Semester/Duration*	*Credits*
Multimedia	INT214	3/Longitudinal	3(2,0,3)

Topics include fundamentals of multimedia, media and data streams, sound/audio, image, graphics, video and animation, topics in data compression including coding requirements, source, entropy, and hybrid coding, JPEG, H.261, MPEG, MP3 and etc, computer technology issues such as communication architecture, multimedia workstations, cache systems, storage systems and optical storage, multimedia operating system issues such as real-time operation, resource management, process management, file systems, and multimedia networking, multimedia synchronization, presentation requirements, reference model, and synchronization techniques, multimedia database issues such as data organization, indexing and retrieval, multimedia applications including digital libraries, system software, toolkits, conferencing paradigms, structured interaction support, and examples from video/audio/graphics conferencing, latest web technologies.

Title	*Code*	*Semester/Duration*	*Credits*
Database Concepts	COM215	3/Longitudinal	3(2,0,3)

This course covers database design and the use of databases in applications, with a short introduction to the internals of relational database engines. It includes extensive coverage of the relational model, relational algebra, and SQL. The course also features database design and relational design principles based on dependencies and normal forms. Many additional key database topics from the design and application-building perspective are also covered, including indexes, views, transactions, and integrity constraints. Systems such as MapReduce framework and key-value stores will also be covered. There will be a programming project, which explores database design and management in web applications by utilizing appropriate features of SQL.

Title	*Code*	*Semester/Duration*	*Credits*

OPERATING SYSTEMS	HC-COMP 213	Longitudinal	4

This course teaches the fundamentals of operating systems. The following topics are studied in detail: virtual memory, kernel and user mode, system calls, threads, context switches, interrupts, intercrosses communication, coordination of concurrent activities, and the interface between software and hardware. Most importantly the interactions between these concepts are examined.

Title	*Code*	*Semester/Duration*	*Credits*
Statistics and Probabilities	MAT216	3/Longitudinal	3(2,2,0)

Exploring univariate data (types of data, mean and median, standard deviation and variance, range, IQR and finding outliers, graphs and describing distributions). Introduction to probability (counting techniques, combinations and permutations, sets and Venn diagrams, basic probability models, general probability rules). Discrete distributions (random variables, binomial distributions, geometric distributions). Continuous distributions (density curves, the normal distribution, standard normal calculations, sampling distribution of x and ˆp). Bivariate data (scatter plots, correlation, the least squares regression line, residuals, non-linear models). relations in categorical data .

Title	*Code*	*Semester/Duration*	*Credits*
System Analysis and Design-1	SYS217	3/Longitudinal	3(2,2,0)

This module introduces the students to the concepts and skills of system analysis and design. It includes expanded coverage of data flow diagrams, data dictionary, and process specifications. System analysis fundamentals, information requirements analysis, the analysis process, the essentials of design, software engineering and implementation.

Title	*Code*	*Semester/Duration*	*Credits*
Numeric Computation -1	MAT218	3/Longitudinal	3(2,2,0)

This course covers introduction, motivation and applications, computation and error analysis, accuracy and precision, truncation and round-off errors, binary number system, error propagation. Linear systems and equations , matrix representation; Cramer's rule; Gauss elimination, matrix inversion, LU, decomposition,iterative methods, relaxation methods, eigen values. algebraic equations, bracketing methods,bisection, open methods: secant, fixed point,

iteration, Newton-Raphson, multivariate, Newton's method. Regression and curve fitting,linear regression; least squares; total, least squares,interpolation; Newton's, difference formulae,cubic spines.

Semester 4 [24 CHs- 18 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Computer Architecture and Organization	COM221	Longit.	2	-	3	3
2	Human Computer Interaction	INT222	Longit.	2	-	3	3
3	Statistics & Probabilities (II)	SYS223	Longit.	2	2	-	3
4	Database Programming	COM224	Longit.	2	-	3	3
5	Algorithms and Data Structure	COM225	Longit.	2	-	3	3
6	Numeric Computation (II)	MAT226	Longit.	2	2	-	3
7	Operational Research	MAT227	Longit.	2	2	-	3
8	Internet Technology	INT228	Longit.	2	-	3	3
			18	16	6	15	24

Title	*Code*	*Semester/Duration*	*Credits*
Computer Architecture	COM221	4/Longitudinal	3(2,0,3)

The course will cover introduction, History, logical circuits, boolean algebra; combinational circuits; fundamental and additional logical gates; Karnaugh maps, decoders, multiplexors, adders, number representation; ALU; Latches; sequential analysis; registers; processors, registers sets, ISA, control unit; modern architectures.

Title	Code	Semester/Duration	Credits
Human-Computer Interaction	INT222	4/Longitudinal	3(2,0,3)

What is Interaction Design understanding and conceptualizing interaction, understanding users, the process of interaction design, establishing requirements ,prototyping , evaluation , observing users ,emerging trends ,student group presentation.

Title	Code	Semester/Duration	Credits
System Analysis and Design-2	SYS223	4/Longitudinal	3(2,2,0)

Fundamental knowledge, methods and skills needed to analyze and design computer-based systems, the role of the systems analyst, the techniques employed and relationships that need to be maintained, utilization of the structured software development life cycle approach, process modeling, information modeling, system architecture modeling, Object-Oriented modeling using UML. A project is given that covers analysis and design phases of a relatively data-oriented business case with emphasis on data modeling (ER diagrams), process modeling (DFDs), and architectural system design issues (DD, HIPO, IPO).

Title	Code	Semester/Duration	Credits
Database Programming	COM224	4/Longitudinal	3(2,0,3)

Data/Information and processing, file based systems; data processing modes; types of databases; components of DBMS; history and objectives of the development of DBMS; types of data models; roles in the database environment; database architecture; relational algebra and relational calculus; terminology of relational model; associations/relationships; types of keys; data Integrity; views; indexes; design and administration; database system development life cycle; phases and types of database design; data administration and database administration; ER-Modeling using UML; normalization; handling problematic and redundant data; functional dependencies; transitive dependencies; identifying normal forms; writing SQL commands; creating and indexing the tables; formatting query results into reports; usage of SQL-Plus**.**

Title	*Code*	*Semester/Duration*	*Credits*
Data Structures and Algorithms	COM225	4/Longitudinal	3(2,0,3)

Introduction to data structures and algorithms, arrays, sorting algorithms, searching algorithms, stacks, stacks applications, queues priorities queues, linked list, double linked list, stacks and queues applications using linked list, introduction to tree, binary Tree.

Title	*Code*	*Semester/Duration*	*Credits*
Numeric Computation -2	MAT226	4/Longitudinal	3(2,2,0)

Introduction, numerical differentiation, higher order formulae. integration and integral equations, trapezoidal rules; Simpson's rules; quadrature. ODEs: initial value problems, Euler's methods; Runge-Kutta methods; predictor-corrector methods, adaptive step size; stiff ODEs, boundary value problems, shooting method; finite differences; over/under relaxation. PDEs, introduction to partial differential equations.

Title	*Code*	*Semester/Duration*	*Credits*
Operations Research	MAT227	4/Longitudinal	3(2,2,0)

Introduction to Operations Research (OR), introduction to foundation mathematics and statistics. Linear Programming (LP), LP and allocation of resources, LP definition, linearity requirement, maximization then ninimization problems. Graphical LP minimization solution, introduction, simplex method definition, formulating the simplex model. linear programming – simplex method for maximizing. Simplex maximizing example for similar limitations, mixed limitations, example containing mixed constraints, minimization example for similar limitations. sensitivity analysis: changes in objective function, changes in RHS, the transportation model, basic assumptions. solution methods: (feasible solution: the northwest method, the lowest cost method. Optimal solution: the stepping stone method, modified distribution method, the assignment model.

Title	***Code***	***Semester/Duration***	***Credits***
Internet Technologies	INT228	4/Longitudinal	3(2,0,3)

Introduction to HTML5:introduction, editing HTML5,first HTML5 example,W3C html5 validation service, heading, linking, images, special characters and horizontal rules, lists, tables, forms, internal linking, meta elements, new HTML5 form input types, input and datalist elements and auto complete attribute, page structure elements, introduction to Cascading Style Sheets(CSS): inline styles, embedded style sheets, positioning elements, backgrounds, elements dimensions, box model and text flows, media types and media queries, drop down menus, text shadows, rounded corners, color, box shadows, linear gradients, radial gradients, multiple background images, image borders, animation selectors, transitions and transformations, Java Script: introduction to scripting, control statements, functions, arrays, objects, JavaScript event handling: reviewing the load event, event mouse move and the event object, rollovers with mouse over and mouse out, form processing with focus and blur, more form processing with submit and reset, event bubbling, more events introduction to canvas : canvas coordinate system, rectangles, using paths to draw lines, drawing arcs and circles, shadows, quadratic curve, Bezier curves, linear gradients, radial gradients, images, image manipulation, patterns, transformations, resizing the canvas to fill the browser, alpha transparency, compositing, save and restore methods, note on canvas SVG and canvas 3D, Ajax-Enabled Rich Internet Applications with XML and JSON: introduction, Rich Internet Applications (RIAs) with Ajax, history of Ajax, “Raw” Ajax Example using the XML Http Request Object, using XML and the DOM, creating a Full-Scale Ajax-Enabled Application, web servers: introduction, HTTP transactions, multitier application architecture, client-side scripting versus server-side scripting, accessing web servers, apache, MySQ Land PHP installation, Microsoft IIS express and web matrix. PHP: introduction, simple PHP program, converting between data types, arithmetic operators, initializing and manipulating arrays, string comparison, string processing with regular expressions, form processing and business logic, reading from a database, using cookies, dynamic content.

Semester 5 [21 CHs- 18 weeks]

	Title	Code	Weeks	Units			CH

				Th	Tut	Prac	
1	Programming Methods (II) (OOP)	COM311	Longit.	2	-	3	3
2	Computer Networks and Communications	INT312	Longit.	2	-	3	3
3	Database Applications	SYS313	Longit.	2	-	3	3
4	Software Engineering (I)	SWE314	Longit	2	-	3	3
5	Visual Programming	COM315	Longit	2	-	3	3
6	Algorithms Analysis and Design	COM316	Longit	2	2	-	3
7	Compilers Design	COM317	Longit.	2	2	-	3
			18	14	4	15	21

Title	*Code*	*Semester/Duration*	*Credits*
Object Oriented Programming	COM311	5/Longitudinal	3(2,0,3)

Definition of object oriented, inheritance, multiple inheritance, encapsulation, polymorphism, introduction to interfaces, dealing with interfaces, packages, application cases. Graphical User Interface (GUI), GUI application .

Title	*Code*	*Semester/Duration*	*Credits*
Computer Networks and Communications	INT312	5/Longitudinal	3(2,0,3)

Topics covered basic concepts of networking, network topologies, the concept of layered architecture modeling including OSI and the TCP/IP protocol suite. Client-server communications, physical layer functionalities including signaling, modulation, multiplexing, line coding and synchronization. Transmission media, network performance measures including throughput, delays are presented, data vs. signaling rates, channel bandwidth and capacity, link layer functionalities including frame synchronization, error detection and control including ARQ, flow control mechanisms including sliding windows, circuit, packet and virtual circuit switching technologies, local area network technologies including Ethernet, token rings, multiple-access schemes such as CSMA/CD, CSMA/CA and token-passing. MAC addressing. switched vs. shared Ethernets.. Performance evaluation, including throughputs and delays, internetworking devices including repeaters, bridges, switches, routers and gateways. Network layer protocols, including IP, ARP and ICMP. IP addressing schemes. Subnetting, internet routing including protocols used in the internet such as RIP, OSPF and BGP, Transport layer protocols including UDP and TCP. Ports and sockets. TCP connection establishment. Error, flow and

congestion control in TCP, applications layer protocols such as HTTP, FTP, DNS, SMTP, TELNET, network security measures including encryption, authentication, data integrity and firewalls.

Title	*Code*	*Semester/Duration*	*Credits*
Database Applications	SYS313	5/Longitudinal	3(2,0,3)

Covers object-relational database systems and using them in programming and in web applications. Topics include: Object-relational database systems, the relational data model, the PL-SQL language, SQL queries, installing and using database systems, using graphical user interfaces for database management. Programming database systems using database , middleware. Programming web-based database application using middleware.

Title	*Code*	*Semester/Duration*	*Credits*
Software Engineering I	SWE314	5/Longitudinal	3(2,0,3)

What is software engineering? software lifecycle and process models, software engineering tools and programming environments, overview of software project management, software requirements specification, software design, using APIs, software verification and validation, and software evolution. Software engineering tools for modeling such as: visual paradigm UML or rational rose will be covered in lab extensively covering flow-oriented modeling, behavioral modeling, scenario-base modeling and class modeling.

Title	*Code*	*Semester/Duration*	*Credits*
Visual Programming	COM315	5/Longitudinal	3(2,0,3)

Course introduction, syllabus, introduction to computing , program design and implementation, essential VB, variables, data types, commenting , arithmetic operators and expressions, decision structures (ifs and select case) , loops (while, for) , loop applications (summation, counting) , sub procedures (val and ref parameters) , functions (val and ref parameters) , strings , arrays , more arays, files, databases.

Title	*Code*	*Semester/Duration*	*Credits*
Algorithms Analysis and Design	COM316	5/Longitudinal	3(2,2,0)

Introduction, algorithm definition, algorithm analysis, recurrence relations, design & analysis of algorithms: divide and conquer greedy algorithm, dynamic programming, lower bound theory, sorting and searching, NP-complete problems: basic concepts.

Title	Code	Semester/Duration	Credits
Compliers Design	COM317	5/Longitudinal	3(2,2,0)

Specific topics covered in this course include: Overview of compilation , lexical analysis ,context-free grammars, top-down and bottom-up parsing, error recovery , abstract syntax trees, symbol tables, lexical scoping, types (primitive, record, arrays, references), type checking, object-oriented type systems, subtyping, interfaces, traits, three-address code and other intermediate representations, code generation, data representation, memory management, object layout , code transformation and optimization , class hierarchy analysis , dataflow analysis , register allocation , run-time systems, just-in-time compilation, garbage collection.

Semester 6 [21 CHs- 18 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Software Engineering (II)	SWE321	Longit.	2	-	3	3
2	Operating Systems Concepts	COM322	Longit.	2	-	3	3
3	Open Source Software & Technologies	INT323	Longit.	2	-	3	3
4	Research Methodology	HMS324	Longit.	2	2	-	3
5	Computer Graphics and Visualization	COM325	Longit.	2	-	3	3
6	Data Mining	COM326	Longit.	2	2	-	3
7	E-commerce	INT327	Longit.	2	2	-	3
			18	14	6	12	21

Title	Code	Semester/Duration	Credits
Software Engineering II	SWE321	6/Longitudinal	3(2,0,3)

This course covers the software development process, from requirements elicitation and analysis, through specification and design, to implementation, integration, testing, and maintenance (evolution). A variety of concepts,

principles, techniques, and tools are presented, encompassing topics such as software processes, project management, people management, software requirements, system models, architectural and detailed design, user interface design, programming practices, verification and validation, and software evolution. Although the emphasis will be on modern approaches some more traditional software engineering techniques will also be discussed.

Title	*Code*	*Semester/Duration*	*Credits*
Operating Systems	COM322	6/Longitudinal	3(2,0,3)

Course Outline: Overview: background, computer-system structures, operating system structures. Process management: processes and threads, process synchronization, deadlocks, CPU scheduling. Storage management: memory management, virtual memory, file-system interface, file-system implementation, I/O systems: I/O, secondary-storage structure. Distributed systems: network and distributed system structures, distributed file systems, distributed coordination.

Title	*Code*	*Semester/Duration*	*Credits*
Open Source software and technologies	INT 323	6/Longitudinal	3(2,0,3)

Open source software: definitions and history where open source is successful open source: the good, the bad and the ugly. Five immediate open source opportunities five more open source opportunities. Open source server applications open source desktop applications. How open source software is developed managing system implementation. application architecture the cost of open source systems. Exploring the android API. perspective and architecture overview,design philosophy,anatomy of an andro id application, application life cycle.

Title	*Code*	*Semester/Duration*	*Credits*
Computer Graphics	COM325	6/Longitudinal	3(2,0,3)

Introduction: history of computer graphics, graphics architectures and software, imaging: pinhole camera, human vision, synthetic camera, modeling vs rendering OpenGL: architecture, displaying simple two-dimensional geometric objects, positioning systems, working in a windowed environment. Color: color perception, color models (RGB, CMY, HLS), color transformations. Color in OpenGL. RGB and indexed color. input: working in a network environment, client-server computing; input measure, event, sample and request input, using callbacks, picking. Geometric transformations: affine transformations (translation, rotation, scaling, shear), homogeneous coordinates,

concatenation, current transformation and matrix stacks. Three dimensional graphics: classical three dimensional viewing, specifying views, affine transformation in 3D, projective transformations. Ray tracing. Shading: illumination and surface modeling, Phong shading model, polygon shading. Rasterization: line drawing via Bresenham's algorithm, clipping, polygonal fill, bitblt. Introduction to hidden surface removal (z buffer). Discrete techniques: buffers, bitblt, reading and writing bitmaps and pixel maps, texture mapping, compositing, advanced topics.

Title	*Code*	*Semester/Duration*	*Credits*
Scientific Research Methodologies	HMS324	6/Longitudinal	3(2,2,0)

Research techniques: basic research and applied research, data collection techniques, sampling techniques; data processing; research methods: subject selection, subject restriction, reference collection; definition of the problem or the subject in details definition of solution techniques or analysis methods, researching and performing practical works, results; reporting: page set up, sentence structure, headings, abbreviation formats, figure and table formats, table of references format. Computer application using SPSS is required.

Title	*Code*	*Semester/Duration*	*Credits*
Data Mining	COM326	6/Longitudinal	3(2,2,0)

Introduction to Data Mining (DM), motivation for data mining - data mining-definition and functionalities – classification of DM systems - DM task primitives - integration of a data mining system with a database or a data warehouse - issues in DM – KDD process . Data pre-processing, why to pre-process data? - data cleaning: missing values, noisy data - data integration and transformation - data reduction: data cube aggregation, dimensionality reduction - data compression - numerosity reduction - data mining primitives - languages and system architectures: task relevant data - kind of knowledge to be mined - discretization and concept hierarchy. Concept description and association rule mining, what is concept description? - data generalization and summarization-based characterization - attribute relevance - class comparisons association rule mining: market basket analysis - basic concepts - finding frequent item sets: a priori algorithm - generating rules – improved a priori algorithm – incremental ARM – associative classification – rule mining, classification and prediction , what is classification and prediction? – issues regarding classification and prediction: classification methods: decision tree, Bayesian classification, rule based, CART, neural network , prediction methods: linear

and nonlinear regression, logistic regression ,introduction of tools such as DB Miner /WEKA/DTREG DM tools.

Title	*Code*	*Semester/Duration*	*Credits*
E-Commerce	INT327	6/Longitudinal	3(2,2,0)

This course focuses on electronic commerce applications, technologies, and tools which are used to conduct business on the World Wide Web. It reviews foundations of e-commerce, its infrastructure, current business models in business-to-customers (B2C) and business-to-business (B2B) transactions, security and quality assurance, web site design strategies, payment systems, and various issues—Internet marketing, legal, regulatory, technological, social, and ethical--which relate to electronic business, systems development issues, electronic data interchange, web-based marketing, e-supply chains, e-procurement, e marketplace, customer relationship management, and web-enabling mobile. A major part of the course will be devoted to hands-on practices covering client-side (front-end) and server- side (back-end) applications in web-based business information systems. Essentials of contemporary programming tools for e-commerce development such as HTML, XML, ASP (VB/JavaScript) ... will be explored.
E-business case studies are used to demonstrate the advantages and the challenges related to integrating ecommerce applications.

Semester 7 [18 CHs- 18 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Information Security	INT411	Longit.	2	2	-	3
2	Parallel and Distributed Computing	COM412	Longit.	2	2	-	3
3	IT Project Management	INT413	Longit.	2	2	-	3
4	Artificial Intelligence	COM414	Longit.	2	-	3	3
5	Simulation and Modelling	COM415	Longit.	2	-	3	3

6	Elective (1)	COM416	Longit.	2	-	3	3
			18	12	6	9	18

Title	Code	Semester/Duration	Credits
Information security	INT411	7/Longitudinal	3(2,2,0)

Topics include foundations: security mindset, essential concepts (policy, CIA, etc), software security: vulnerabilities and protections, malware, program analysis, practical cryptography: encryption, authentication, hashing, symmetric and asymmetric crypto networks: wired and wireless networks, protocols, attacks and countermeasures, applications and special topics: databases, web apps, privacy and anonymity, voting, public policy.

Title	Code	Semester/Duration	Credits
Parallel and Distributed Computing	COM412	7/Longitudinal	3(2,2,0)

PART I: synchronous parallel models and algorithms, overview of parallel models and analysis of parallel algorithms. Combinational circuits, parallel computation using circuits. The PRAM model and several PRAM algorithms will be discussed. Interconnection network models such as linear arrays, 2D meshes, hyper cubes. Models using buses including a reconfigurable mesh and a linear array with optimal buses. The locally developed MSIMD model called MASC. Asynchronous parallel models including SPMD, BSP and LogP.

PART I I: distributed algorithms, introduction, locality-sensitivity, distributed network models, broadcast, converge cast, downcast, upcast, tree constructions, synchronizers, vertex coloring, maximal independent sets, message routing, locality-preserving representations, applications of locality-preserving representations.

Title	Code	Semester/Duration	Credits
IT Project Management	INT413	7/Longitudinal	3(2,2,0)

Introduction to project management concepts, tools, and techniques; project integration management; project planning, scope management, scheduling, budget control, human resource management, communication management, risk analysis and management, project quality management, and procurement management. MS-Project will be demonstrated and used as a tool for creating project management documents.

Title	Code	Semester/Duration	Credits
Artificial Intelligence	COM414	7/Longitudinal	3(2,0,3)

An introduction to the basic principles, techniques, and applications of artificial intelligence. Coverage includes knowledge representation, logic, inference, problem solving, search algorithms, game theory, perception, learning, planning, and agent design. Students will experience programming in AI language tools. Potential areas of further exploration include expert systems, neural networks, fuzzy logic, robotics, natural language processing, and computer vision.

Title	Code	Semester/Duration	Credits
Simulation and Modeling	COM415	7/Longitudinal	3(2,0,3)

Introduction, course logistics, definitions of modeling and simulation, when to apply these techniques, applications, terminology & components , discrete vs. continuous time and process flow in simulation study. Simulation examples: queuing systems , communications networks. General principles: event -driven simulation, world views, list processing. Simulation software: history, selection process, simulation in high level language (C, C++, Pascal, Fortran), simulation packages (Matlab / Simulink), interpreted vs. compiled simulators, future trends. Statistical models: terminology and concepts, useful statistical models, distributions. Queuing models: characteristics, performance measures, steady-state behavior, networks of queues. Random number generation: properties of random numbers, generation of pseudo-random numbers, testing for randomness, pitfalls.

Title	Code	Semester/Duration	Credits
Mobile Device Programming technologies	COM421	8/Longitudinal	3(2,0,3)

Introduction to mobile computing, mobile platforms & architectures, mobile Java – J2ME, android operating system: It is architecture and its programming implementation using Eclipse, JDK and SDK. iOS operating system, symbian S60 OS-Windows phone 7, wireless telecommunication, wireless networks, mobile security, mobile databases, mobile multimedia services, emerging mobile technologies.

Title	Code	Semester/Duration	Credits
Computer Ethics	HMS422	8/Longitudinal	2(2,0,0)

This course introduces students to the topics of information technology ethics including: definitions, rules & policies of computer ethics, hacking, viruses, internet ethics, freedom of expression on the internet, computer professionals and social responsibilities, software copyright, intellectual property, software piracy, cyber law and privacy & security of computerized information Topics: an overview of ethics, ethics for IT workers and IT users, computer and internet crime, privacy, intellectual property, the impact of information technology on productivity and quality of life.

Title	*Code*	*Semester/Duration*	*Credits*
Graduation Project	COM425	8/Longitudinal	6(0,0,18)

Students will identify an actual computer related business problem and apply research principles and procedures to reach a solution. This includes development of a proposal, problem formulation as well as data collection and analysis culminating in a presentation of all steps used in the research process. an applied detailed research on a subject in a related field should by conducted by the student as a prerequisite for graduation. Research structure and set up are supposed to strictly follow the scientific research methods and techniques in terms of: definition of the problem or the subject in details, definition of solution techniques or analysis methods, researching and performing practical works, results; reporting: page set up, sentence structure, headings, abbreviation formats, figure and table formats, table of references format.

Semester 8 [17 CHs- 18 weeks]

	Title	Code	Weeks	Units			CH
				Th	Tut	Prac	
1	Mobile Device Programming Technologies	INT421	Longit.	2	-	3	3
2	Professional Ethics	HMS422	Longit.	2	-	-	2
3	Elective (2)	COM423	Longit.	2	2	-	3
4	Elective (3)	COM424	Longit.	2	-	3	3

5	Graduation Project	COM425	Longit	-	-	18	6
			18	8	2	24	17

Title	***Code***	***Semester/Duration***	***Credits***
Information security	INT411	7/Longitudinal	3(2,2,0)

Topics include foundations: security mindset, essential concepts (policy, CIA, etc), software security: vulnerabilities and protections, malware, program analysis, practical cryptography: encryption, authentication, hashing, symmetric and asymmetric crypto networks: wired and wireless networks, protocols, attacks and countermeasures, applications and special topics: databases, web apps, privacy and anonymity, voting, public policy.

Title	***Code***	***Semester/Duration***	***Credits***
Parallel and Distributed Computing	COM412	7/Longitudinal	3(2,2,0)

PART I: synchronous parallel models and algorithms, overview of parallel models and analysis of parallel algorithms. Combinational circuits, parallel computation using circuits. The PRAM model and several PRAM algorithms will be discussed. Interconnection network models such as linear arrays, 2D meshes, hyper cubes. Models using buses including a reconfigurable mesh and a linear array with optimal buses. The locally developed MSIMD model called MASC. Asynchronous parallel models including SPMD, BSP and LogP.
PART I I: distributed algorithms, introduction, locality-sensitivity, distributed network models, broadcast, converge cast, downcast, upcast, tree constructions, synchronizers, vertex coloring, maximal independent sets, message routing, locality-preserving representations, applications of locality-preserving representations.

Title	***Code***	***Semester/Duration***	***Credits***
IT Project Management	INT413	7/Longitudinal	3(2,2,0)

Introduction to project management concepts, tools, and techniques; project integration management; project planning, scope management, scheduling, budget control, human resource management, communication management, risk analysis and management, project quality management, and procurement management. MS-Project will be demonstrated and used as a tool for creating project management documents.

Title	Code	Semester/Duration	Credits
Artificial Intelligence	COM414	7/Longitudinal	3(2,0,3)

An introduction to the basic principles, techniques, and applications of artificial intelligence. Coverage includes knowledge representation, logic, inference, problem solving, search algorithms, game theory, perception, learning, planning, and agent design. Students will experience programming in AI language tools. Potential areas of further exploration include expert systems, neural networks, fuzzy logic, robotics, natural language processing, and computer vision.

Title	Code	Semester/Duration	Credits
Simulation and Modeling	COM415	7/Longitudinal	3(2,0,3)

Introduction, course logistics, definitions of modeling and simulation, when to apply these techniques, applications, terminology & components , discrete vs. continuous time and process flow in simulation study. Simulation examples: queuing systems , communications networks. General principles: event -driven simulation, world views, list processing. Simulation software: history, selection process, simulation in high level language (C, C++, Pascal, Fortran), simulation packages (Matlab / Simulink), interpreted vs. compiled simulators, future trends. Statistical models: terminology and concepts, useful statistical models, distributions. Queuing models: characteristics, performance measures, steady-state behavior, networks of queues. Random number generation: properties of random numbers, generation of pseudo-random numbers, testing for randomness, pitfalls.

Title	Code	Semester/Duration	Credits
Mobile Device Programming technologies	COM421	8/Longitudinal	3(2,0,3)

Introduction to mobile computing, mobile platforms & architectures, mobile Java – J2ME, android operating system: It is architecture and its programming implementation using Eclipse, JDK and SDK. iOS operating system, symbian S60 OS-Windows phone 7, wireless telecommunication, wireless networks, mobile security, mobile databases, mobile multimedia services, emerging mobile technologies.

Title	Code	Semester/Duration	Credits
Computer Ethics	HMS422	8/Longitudinal	2(2,0,0)

This course introduces students to the topics of information technology ethics including: definitions, rules & policies of computer ethics, hacking, viruses, internet ethics, freedom of expression on the internet, computer professionals and social responsibilities, software copyright, intellectual property, software piracy, cyber law and privacy & security of computerized information Topics: an overview of ethics, ethics for IT workers and IT users, computer and internet crime, privacy, intellectual property, the impact of information technology on productivity and quality of life.

Title	*Code*	*Semester/Duration*	*Credits*
Graduation Project	COM425	8/Longitudinal	6(0,0,18)

Students will identify an actual computer related business problem and apply research principles and procedures to reach a solution. This includes development of a proposal, problem formulation as well as data collection and analysis culminating in a presentation of all steps used in the research process. an applied detailed research on a subject in a related field should by conducted by the student as a prerequisite for graduation. Research structure and set up are supposed to strictly follow the scientific research methods and techniques in terms of: definition of the problem or the subject in details, definition of solution techniques or analysis methods, researching and performing practical works, results; reporting: page set up, sentence structure, headings, abbreviation formats, figure and table formats, table of references format.

ELECTIVE COURSES

Elective courses determine by the faculty management according to the strategic plan.

Title	*Code*	*Semester/Duration*	*Credits*
Open Source Operating Systems	COM4xx	Longitudinal	3(2,0,3)

Course Outline:

The course covers Partitioning of hard-drives , Slackware OS Setup, Basic Linux Commands, Network Connectivity, Dual booting w/other O.S., Adding packages sets, Adding partitions, Adding more swap space, Opening User Accounts, Setting up Groups, Setting Permissions on Files & Directories, Groups and Permissions Exercise{graded}, Setting up Telnet Server, Using SSH, Setting up a PROFTPD server, Setting up a VSFTPD server, Configuring TCP forwarding, Starting the Apache Web Server, Default server web site, User's web sites, Executing CGI scripts, Virtual Hosting, Protecting directories with hatches, Installing Apache from Scratch, Configuring an SSL Server.

Title	Code	Semester/Duration	Credits
Knowledge Management	COM4xx	Longitudinal	3(2,0,3)

Course Outline:

The course covers principles of knowledge management (overview, knowledge management solutions, etc.), knowledge management technologies (artificial intelligence, digital libraries, repositories, etc.), knowledge management systems (knowledge discovery systems, knowledge capture systems, knowledge sharing systems, knowledge application systems, etc.).

Title	Code	Semester/Duration	Credits
Genetic Algorithms	COM4xx	Longitudinal	3(2,0,3)

Course Outline:

Basic concepts: representation, objective & evaluation functions, local vs global optima traditional methods: hill climbing, simulated annealing, branch and bound evolutionary approaches: population-based search: genetic algorithms and evolutionary computation, genetic programming, niching , crowding methods, island models, and co-evolution.

Title	Code	Semester/Duration	Credits
Expert Systems	COM4xx	Longitudinal	3(2,0,3)

Introduction to expert systems,knowledge acquisition,knowledge representati on, expert system tools, LISP, CLIPS, expert system implementation, expert system testing.

Title	Code	Semester/Duration	Credits
Computer Network Programming	COM4xx	Longitudinal	3(2,0,3)

Networking basics, protocol basics, internet protocols, and socket programming. This is a project-oriented course. Students will be required to design and implement a layered protocol stack.

Title	Code	Semester/Duration	Credits
Decision Support Systems	COM4xx	Longitudinal	3(2,0,3)

Introduction to DSS, expectations and DSS, decision making, exploring the range of DSS research, knowledge management, project proposals, model

oriented DSS, visualization-oriented DSS, business intelligence and data warehousing, DSS user interfaces, new trends in DSS.

Title	*Code*	*Semester/Duration*	*Credits*
Advanced Computer Network management	COM4xx	Longitudinal	3(2,0,3)

The course covers switching : switch performance measures, time and space switches, modular switch design packet switch and distributed buffer, optical N/W : DWDM., high -speed networks, IP forwarding architectures, overlay model-CLIP, LANE, RSVP, Virtual Private Networks (VPN), MPLS support for VPN ,network management ,case study : HP-open view, inter-vehicular communications and GPS, network monitoring and tuning, troubleshooting.

Title	*Code*	*Semester/Duration*	*Credits*
Advanced Databases	COM4xx	Longitudinal	3(2,0,3)

Introduction, concepts and definitions, normalization techniques , data mining and data warehouse, transaction processing ,concurrency control, distributed databases, database security, temporal database.

Title	*Code*	*Semester/Duration*	*Credits*
Modern Trends in Computer Science	COM4xx	Longitudinal	3(2,0,3)

The course topics will be tailored according to the emphasis of the course selected.

Title	*Code*	*Semester/Duration*	*Credits*
Advanced Algorithms	COM4xx	Longitudinal	3(2,0,3)

combinatorial algorithms (set cover, Steiner tree and TSP, multiway cut, knapsack, minimum make span scheduling), LP-based algorithms (LP duality, set cover via dual fitting, LP rounding techniques, sparsest cut, facility location, semidefinite programming and max-cut) and other topics including approximation algorithms based on algorithmic game theory, hardness of approximation and open problems.

Title	*Code*	*Semester/Duration*	*Credits*
Cryptography	COM4xx	Longitudinal	3(2,0,3)

Basic security concepts ,basic cryptography, hash functions, secret key cryptography , public key, cryptography , authentication ,trusted intermediaries ,real-time communication security, miscellaneous.