

# FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

# CENTRE FOR OPEN DISTANCE AND E-LEARNING (CODeL)

# CURRICULUM OF COMPUTER SCIENCE PROGRAMME

2011/2012 ACADEMIC SESSION

#### FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA CENTRE FOR OPEN DISTANCE AND E-LEARNING (CODEL) DEPARTMENT OF COMPUTER SCIENCE B.TECH. COMPUTER SCIENCE

#### INTRODUCTION

The Department of Computer Science was established in 2009. The Department offers a degree programme of Bachelor of Technology (B.Tech) in Computer Science. Computer Science Department is one of the Departments in the School of Information and Communication Technology (SICT). The Department offers a unique educational opportunity for students to achieve excellence through vigorous classes, practical and participation in cutting edge research.

#### VISION

The vision of the Department is to be a leading academic centre of excellence in Computer Science and to supply the people with ideas that will shape the Computer Science.

#### MISSION

The Department of Computer Science will build and develop human capacity to high level through comprehensive educational programs, research in collaboration with industry and the government, dissemination through scholarly publications, and services to professional societies, the community, the state, the nation and the world.

#### PHILOSOPHY

The philosophy is to build national capacity for the country through technological advancement that drives development, and develop high level manpower that will create job and wealth, and reduce unemployment and poverty.

#### **OBJECTIVES**

Our basic objectives include:

- 1. To provide graduates with solid foundation in Computer Science and knowledge that is required for postgraduate studies and research.
- 2. To provide and promote sound practical and theoretical training in computer hardware, software, and application areas, that will make our graduates useful in both private and public sectors of the economy.
- 3. To develop the students for the purpose of self employment
- 4. To promote the career opportunities offered by Computer Science and to meet with the ongoing needs of the industry.

#### **ADMISSION REQUIREMENTS**

There are three modes of admission into the First Degree Programme.

(a) UME Admission

The requirements are 5 O'Level credits in English Language, Mathematics, Physics, Chemistry, and a science subject, in NECO, WAEC and/or NABTEB as well as a high aggregate score in the University Matriculation Examination.

- (b) DIRECT ENTRY
- i. Holders of minimum of Lower Credit Level in National Diploma in Computer Science/Engineering qualify for admission at 200 Level.

- ii. Holders of HSC/GCE-A Level/IJMB with credit passes in Mathematics, Physics and Chemistry also qualify for 200 Level
- iii. Holders of HND with at least Lower Credit in Computer Science qualify for admission into 300 Level

# (c) UNIVERSITY REMEDIAL PROGRAMME

The requirements are five O' level credits including Mathematics and English Language. The one-year Remedial Programme includes Mathematics, Physics, Chemistry, Geography, English Language and Biology or Agriculture.

# NB:

- i. These direct-entry requirements are in addition to the O'Level grades stipulated in (a) above. Also, direct entry students must take and pass the General Studies courses offered in 100 and 200 Levels.
- ii. All candidates for admission must pass the University Post-UME Screening Exercise.

# **GRADUATION REQUIREMENTS**

To be eligible for the award of B.Tech. (Computer Science), a student must have;

- a. Passed all core (compulsory) courses and electives recommended for the programme.
- b. Accumulated at least 200 course units and obtained a CGPA of not less than 2.00.
- c. Completed successfully all class work, industrial attachments, seminars and projects.

To graduate, a student must be found worthy in character throughout the period of his/her studentship in the University and must accumulate the total units prescribed by the School from Core, Electives and General Studies courses; and SWEP/SIWES and Project. A student must be in good standing in order to go for Industrial Attachment. A student shall not exceed more than 15 semesters.

# **DURATION OF STUDY**

The duration of Bachelor of Technology (B. Tech) study is five years.

# INTRA AND INTER UNIVERSITY TRANSFERS

All candidates seeking transfer (whether intra or inter University) must have spent a minimum of one academic session in the programme of first admission with full Sessional result attached to the application for transfer.

- a. All intra University candidates seeking transfers to Computer Science Department are to have a minimum CGPA of 3.00.
- b. All inter University candidates seeking transfers to Computer Science Department of the Federal University of Technology, Minna must:
  - (i) Be studying an Engineering/Science programme in their current university
  - (ii) Have passed all courses registered in their current university before seeking the transfer.
  - (iii) Having a minimum CGPA of 4.00 out of 5.00 or 3.00 on a scale of 4.00.
  - (iv) Transfer cases can only be entertained up to and not beyond 200L.

**Note**: In all cases, admission is purely based on:

- a. Available vacancies
- b. The number of candidates applying for admission.

## **CONDITIONS FOR PROGRESSION**

The case of screening and weeding is not limited to new students only. The following criteria were approved for the continuing students:

- a. Students crossing from 100L to 200L must have passed 6 out of 8 credit load for each of Mathematics and Physics and 6 out of 9 credit load of Chemistry.
- b. Must have a CGPA of not less than 2.00.
- c. Must clear all carry over courses before going to 400 level

## **PROGRAMME STRUCTURE**

The program structure for Computer Science from 100 level to 500 level is as follows:

**100 Level** – Students are expected to take relevant courses in basic science such as Mathematics, Physics, Chemistry, Environmental Science, and General Studies, which will serve as foundation upon which the courses at subsequent levels are to be based. Also introductory courses in Computer, Technical Drawing, and Workshop Practices are included.

**200 Level** – Students of this level take Computer Science courses as well as courses in Mathematics and Statistics.

**300 Level** – Students at this level take more Computer Science courses with a General Studies course.

**400 Level** – Detailed and specific courses in Computer Science are taken by the students of this level with practical. In the second semester, the students undertake Industrial Work Experience Scheme (SIWES) for six months.

**500 Level** – At this level, the students take more detailed and specific courses in Computer Science, with seminar presentation and research project. The students are equally passed through oral defense and examination by the Department's external examiner.

## COURSE STRUCTURE 100 LEVEL FIRST SEMESTER

COURSE	COURSE TITLE	UNIT	STATUS	STR	STRUCTURE		PRE-REQUISTE
CODE				L	Р	Т	
MAT111	Abstract and Trigonometry	3	Core	2		1	
MAT112	Vectors, Geometry and Dynamics	3	Core	1		1	
STA117	Introduction to Statistics	2	Core	2			
CPT111	Introduction to Computer	2	Core	2			
PHY113	Mechanics	3	Core	3			
CHM111	Physical Chemistry	3	Core	3			
GST110	Use of English and Library	3	Core	2	1		
TCD111	Technical Drawing	1	Core		1		
WKS110	Workshop Practices	1	Core				
GST105	Introduction to Nigerian Law	2	Core	2			
IMT 112	Basic Computer Tools	1	Core				
	TOTAL	24					

COURSE	COURSE TITLE	UNIT	STATUS	STATUS STRUCTURE			PRE-
CODE				REQ	<b>QUISITE</b>		
				L	Р	Т	
MAT 121	Differential and Integral Calculus	3	Core	2			
STA 127	Probability I	2	Core	2			
CPT 121	Introduction to Programming	2	Core	2			
GST 121	Use of English II	2	Core	2			
GST 103	Nigerian People and Culture	2	Core	2			
GST 104	Introduction to Economics	2	Core	1			
CHM 121	Organic Chemistry	3	Core	2	1		
GRY 124	Introduction to Environmental Science	3	Core	2	1		
PHY 123	Properties of Matter	3	Core	2		1	
PHY 126	Electricity and Magnetism	2	Core	2			
	TOTAL	24					

## 200 LEVEL FIRST SEMESTER

COURSE	COURSE TITLE	UNIT	STATUS	STR	STRUCTURE		PRE-REQUISITE
CODE				L	Р	Т	1
MAT 212	Linear Algebra II	3	Core	2			MAT 111, MAT 112
MAT 213	Mathematical Methods	2	Core	2			
STA 217	Probability II	2	Core	2			STA 127
CPT 211	Object-Oriented Programming I	2	Core	2			CPT 121
CPT 212	Hardware Systems and Maintenance	2	Core	2			
CPT 213	Introduction to Computer System	2	Core	1			CPT 121
CPT 214	Computer Architecture	3	Core	2	1		CPT 111
GST 211	Logic and Philosophy	3	Core	2	1		
	TOTAL	20					

COURSE	COURSE TITLE	UNIT	STATUS	STR	STRUCTURE		PRE-REQUISITE
CODE				L	Р	Т	
MAT222	Linear Algebra II	2	Core	2			MAT 111, MAT 112
MAT 224	Discrete Mathematics	3	Core	2			
MAT225	Introduction to Numerical Analysis	3	Core	2		1	MAT 111, MAT 112
CPT221	Object-Oriented Programming II	3	Core	2	1		CPT 121
CPT222	Data Structures	3	Core	2		1	CPT 121
CPT223	Algorithms	3	Core	2		1	CPT 121
CPT 224	Electronic Commerce Technology	2	Core	2			
	TOTAL	19					

# 300 LEVEL FIRST SEMESTER

COURSE	COURSE TITLE	UNIT	STATUS	STR	UCT	URE	PRE-REQUISITE
CODE				L	Р	Т	
CPT 311	Organization and Design of Programming Language	2	Core	2			CPT 121, CPT 221
CPT 312	Programming Language Translation I	3	Core	2		1	CPT 214
CPT 313	Operating System	3	Core	2			CPT 214
CPT 314	Introduction to Wide Design	2	Core	2			
CPT 316	Systems Analysis and Design	3	Core	2		1	CPT 222
CPT 317	Data Communication and Networks I	3	Core	2	2		CPT 214
CPT 318	Introduction to World Wide Web	2	Core	2	1		
GST 311	Entrepreneurship I	2	Core				
	TOTAL	20					

COURSE	COURSE TITLE	UNIT	STATUS STRUCTURE			URE	PRE-REQUISITE
CODE				L	Р	Т	
CPT 321	Computer Graphics	3	Core	2	1		CPT 111
CPT 322	Introduction to Digital Design and						
	Microprocessors	3	Core	2		1	CPT 214
CPT 323	Automata, Computability and Complexity	2	Core	2	1		CPT 111
CPT 324	Information Management	2	Core	2		1	CPT 211
CPT 325	Database Design and Management	2	Core	2			CPT 222
CPT 326	Computer and Network Security	2	Core	2			
CPT 327	Data Communication and Network II	3	Core	2	1		CPT 214, CPT 317
CPT 328	Programming Language Translation II	3	Core	2		1	CPT 312
	TOTAL	20					

400 LEVEL
FIRST SEMESTER

COURSE	COURSE TITLE	UNIT	STATUS	STRUCTURE		URE	PRE-REQUISITE
CODE				L	Р	Т	
CPT 411	Net-centric Computing	2	Core	2			CPT 317
CPT 412	Information Systems	2	Core	2		1	CPT 324
CPT 413	Systems Operations Research	3	Core	2		1	
CPT 414	Design and Analysis of Algorithms	2	Core	2			CPT 222
CPT 415	Compiler Construction	3	Core	2		1	
CPT 416	Software Design, Techniques and Management	3	Core	2			
CPT 417	Computer Ethics	2	Core	2			
CPT 418	Cloud Computing	2	Core	2			
CPT 419	Seminar	2	Core				
	TOTAL	21					

COURSE	COURSE TITLE	UNIT	STATUS	STR	UCT	URE	PRE-REQUISITE
CODE				L	Р	Т	
CPT 421	SIWES	12	Core				

COURSE	COURSE TITLE	UNIT	STATUS	STR	UCT	URE	PRE-REQUISITE
CODE				L	Р	Т	
CPT 511	Data Warehousing	2	Core	2			
CPT 512	Grid Computing	2	Core	2		1	
CPT 513	System Simulation and Modeling	2	Core	2		1	
CPT 515	Artificial Intelligence	3	Core	2			
CPT 516	Advance Database Systems	2	Core	2		1	CPT 325
CPT 517	Software Engineering	3	Core	2			CPT 316
CPT 518	Entrepreneurship II	2	Core	2	2		CPT 311
CPT 519	Computer Installation and Maintenance	2		2			
	ELECTIVES [1]						
CPT 514	Software Testing, Verification and Validation	2	Electives	2	1		
CPT 510	Real Time Systems	2	Electives	2			
	TOTAL	20					

#### 500 LEVEL FIRST SEMESTER

COURSE	COURSE TITLE	UNIT	STATUS	STR	UCT	URE	PRE-REQUISITE
CODE				L	Р	Т	H
CPT 521	System Performance Evaluation	2	Core	2	1		
CPT 522	Data Mining	2	Core	2		1	CPT 325,CPT 511
CPT 523	Neural Networks	2	Core	2	1		CPT 515
CPT 524	Expert Systems	3	Core	2		1	CPT 515
CPT 529	Project	6	Core	2			
	ELECTIVES [1]						
CPT 527	Visual Programming	3	Elective	2			CPT 111
CPT 528	Introduction to Internet Programming	3	Elective	2	1		
CPT 526	Fault-Tolerant System	3	Elective	2		1	
CPT 520	Introduction to Mobile Computing	3	Elective	2			
	TOTAL	18					

#### **COURSE DESCRIPTION**

### MAT 111: ALGEBRA AND TRIGONOMETRY (Core 3 Units)

Elementary set theory, subsets, union, intersection, complements, Venn diagrams. Number systems, real number system, complex number system, real line, inequality, surds, indices and logarithms, mathematical induction, sequence and series, partial fraction. Equations, polynomials, remainder theorem, completing the square, change of variable, reciprocal equation, method of rationalization, simultaneous equation, theory of quadratic equations, Binomial theorem, Matrices and Determinants, circular measure, trigonometric functions of angles of any magnitude, addition and factor formulae.

#### MAT 112: VECTOR, GEOMETRY AND DYNAMICS (Core, 3 Units)

Geometric representation of vector in 1-3 dimensions components direction cosines, scalars and vector with respect to a scalar variable. Coordinate geometry, distance between two points, equation of straight line, equation of a line in normal form, equation of tangent, equation of ellipse, equation of parabola, equation of hyperbola, equation of conic section, equation of a circle. Tangents, normal, kinematics of a particle. component of velocity and acceleration of a particle moving in a plane. Force, momentum, laws of motion under gravity, projectiles, resisted vertical motion, elastic string, simple pendulum impulse impact of two smooth sphere, and of a sphere on a sphere.

#### **STA 117: INTRODUCTION TO STATISTICS (Core, 2 Units)**

Statistical data, their sources, collection and preliminary analysis by tables and graphs, measure of location and dispersion (for grouped and ungrouped data), skewness and kurtosis; simple regression and correlation analysis, index numbers.

#### **CPT 111: INTRODUCTION TO COMPUTER (Core, 2 Units)**

Background: History of computing; overview of programming languages and the compilation process. Algorithms: Definition, design and implementation; introduction to classical algorithms (sorting, searching, and pattern matching). Algorithmic Analysis: efficiency; asymptotic analysis; computational complexity; big-O notation; polynomial versus exponential growth; computability. Fundamental Programming Constructs: Syntax and semantics of a higher-level language; variables, types, expressions, and assignment; simple I/O; conditional and iterative control structures; functions and parameter passing; structured decomposition; brief introduction to a programming language that supports the objectoriented paradigm. Hardware Realizations of Algorithms: Data representation; von Neumann model of computation; the fetch/decode/execute cycle; basic machine organisation. Operating Systems and Virtual Machines: Historical evolution of operating systems. Networking and Computer Graphics: Brief introduction to some of the basic concepts in networking and computer graphics. Computing Applications: Word processing; spreadsheets; editors; files and directories. Overview of programming languages: History of programming languages; brief survey of programming paradigms; the role of language translation in the programming process, Introduction to the Internet: Background and history of networking and the Internet; Web technologies; the HTML protocol; the format of a web page; support tools for web site creation. Computing applications: Word processing; spreadsheets; editors; files and directories.

## PHY 113: MECHANICS (Core, 3 Units)

Space and Time, Frames of References. Units and Dimensions: Fundamental and Derived Units in S. I. Unit. Dimensional Analysis of Equations.

Motion and Forces: Velocity and acceleration – relationships for uniformly accelerated motion. Scalars, vectors, vector addition and subtraction, relative velocity, Newton's laws of motion: Conversation of energy and momentum, collisions: elastic collisions, work, energy and power. Circular motion: centripetal force, barking of tracks, motion along horizontal and vertical circles, Galilean invariance; Gravitational force; Inverse square law, gravitational constant, gravitational potential and field. Velocity – synchronous orbit; escape velocity, weightlessness. Rotation of rigid bodies: Moment of inertia; theorems of moment of inertia. Conservation of angular momentum, rolling bodies.

Statics: Composition and resolution of forces, concurrent and parallel forces, conditions for equilibrium, centre of gravity for component bodies and bodies from which part is removed.

## GST 105: INTRODUCTION TO NIGERAN LAW (Core, 2 Units)

The meaning of Law. Schools of Thought: naturalist school, positivist school, realist school, sociological school, historical school.. Legal terms and terminologies. Classification of Law. Sources of Nigerian Law: Local (Nigerian legislations; received English law; the doctrines of equity; the statutes of general application; judicial precedents; books of authority. Nigerian Court system. Nigerian constitutional development. The rule of law. Separation of powers. Impeachment proceedings. The immunity clause, extents and limitations. Revenue allocation and the constitutional derivation formula. The Constitutional provision on fundamental human rights. Citizenship.

## GST 110: USE OF ENGLISH I AND LIBRARY (Core, 3 Units)

1. General Introduction to Effective Communication and Writing English: Definition of Communication; The elements and process of Communication.

2. Writing Effectively: Writing of essays, including answers to examination questions; Academic sources of information; Key areas in answering Examination questions; Vocabulary of questions; Explanations of question terminologies; sample questions and analyses.

3. Definition of Reports/Technical Report; Purpose of writing technical report; Skills in Technical report writing e.g. Exposition, Narration, Description and Argumentation. Attributes of a Technical Report. Characteristics of Technical and Non-technical writing. Aspects that make for effective technical report writing. Categories of Technical reports – Formal and informal. Examples of Formal Technical report. Basic outline/structure.

4. Research Report Writing as a variety Technical Report: Definition of Research. Objectives of writing a research Report. The Research process. Varieties/Types of researches e.g. experimental, empirical, observation, case study, surveys. Sections of a research report and their functions e.g. Title, Abstract, Review of Literature, etc. Data collection methods in Research Writing.

5 Use of Library: Nature and Concept of Library. Introduction. The library users. The five fundamental laws of librarianship. The importance of the course "Use of Library" /Aims and objectives of user education. Types of Libraries. The charging system. Functions of a University Library.

## TCD 111 – TECHNICAL DRAWING (Core, 1 Unit)

Aims and objective of Technical drawing. Differences between technical drawing and fine art and photography. Drawing equipment, drawing layout, numbering and lettering, principles of construction of common figures. Construction of angles, triangles, circles, tangent, quadrilaterals and polygons using different methods of construction. Methods of dividing circle, four equal circles in a square etc.

## WKS 110 – WORKSHOP PRACTICES (Core, 1 Unit)

Use of engineering measuring instruments e.g clippers gauge. Introduction to hand tools e.g. practise in wood planners, saws, sanders and pattern making. Sampling and sizing techniques of raw materials. Sheet metal work; production of sheet and metal products layout, cutting and shaping, gas welding, soldering, brazing, fastening and assembling. Woodwork: basic woodworking principles and tools layout methods, cutting and evaluation, finished products.

## GST 104 – INTRODUCTION TO ECONOMICS (Core, 2 Units)

The course introduces students to the following topics: Scope and nature of economics; the price system; theory of cost and production; the market structure; Business organizations; Money; Inflation; National income; Microeconomics and Macroeconomics.

## GST 121: USE OF ENGLISH II (Core, 2 Units)

Reading Techniques and Study Skills and Reading Comprehension: Definition/Concept of Reading . Reading purposes. Reading strategies. Reading techniques, skimming, scanning SQ3R, main ideas in a passage and others. Summary writing. Vocabulary development - How to enrich your vocabulary, Registers/Lexis, American and British vocabulary differences. Oracy skills.

# MAT 121: DIFFERENTIAL AND INTEGRAL CALCULUS (Core, 3 Units)

Function of a real variable, graphs, limits and idea of continuity. The derivative, as limit of change, techniques of differentiation. Extreme curve sketching; Integration as an inverse of differentiation, method of integration, definite integrals, application to area, volume.

## CPT 121: INTRODUCTION TO PROGRAMMING (Core, 2 Units)

Programming Languages: History of programming languages; brief survey of programming paradigms (procedural, object-oriented, functional). overview of programming languages and the compilation process. Fundamental programming constructs: Syntax and semantics of a higher-level language; variables, types, expressions, and assignment; simple I/O; conditional and iterative control structures; functions and parameter passing; structured decomposition Algorithms and Problem-solving: Problem-solving strategies; the concept of an algorithm; properties of algorithms; implementation strategies; sequential and binary search algorithms; quadratic sorting algorithms (selection, insertion). Principles of Encapsulation: Encapsulation and information-hiding; separation of behaviour and implementation. Fundamental Data Structures: Primitive types; arrays; records; strings and string processing; pointers and references; static, stack, and heap allocation; runtime storage management. Machine level Representation of Data: Bits, bytes, and words; binary representation of integers; representation of character data; representation of records and arrays. Assembly level Machine organisation: Basic organisation of the von Neumann machine; instruction fetch, decode, and execution; assembly language programming for a simulated machine. Software Development Methodology: Fundamental design concepts and principles; structured design; testing and debugging strategies; strategies; test-case design. Recursion: The concept of recursion; recursive mathematical functions; simple recursive procedures; implementation of recursion

## GST 103: NIGERAN PEOPLES AND CULTURE (Core, 2 Units)

Study of Nigerian history; Culture and arts in pre-colonial times; Nigerian's perception of his world; Culture areas of Nigeria and their characteristics; Evolution of Nigeria as a political Unit; Indigene/settler phenomenon; Concepts of trade; Economic self-reliance; Social justice; Individual and national development; Norms and values; Negative attitudes and conducts

(cultism and related vices); Re-orientation of moral and national values; Moral obligations of citizens; Environmental problems.

# IMT 112: BASIC COMPUTER TOOLS (Core, 1 Unit)

Introduction to application software .Hands-on practical on word processing, record management, database, spreadsheet, communication, spreadsheet software, Hand-on-Internet surfing and down loading. Power point presentation.

## STA 127: PROBABILITY I (Core, 2 Units)

Generation of statistical events from set theory and combinatorial methods; elementary principle of probability: addition, multiplication and conditional probability, Bayes' rule, one dimensional random variables (discrete and continuous); Types and distribution of random variables (discrete and continuous), their expectations and moments, Application to the Bernoulli, binomial, poison, geometric, hypergeometric, normal and exponential distributions.

# PHY 123: PROPERTIES OF MATTER (Core, 2 Units)

Atomic Viewpoint, interatomic forces, melting and evaporation in molecular terms. SVP in terms of dynamic equilibrium. The Zeroth law of thermodynamics: Kinetic theory of gases, assumptions, pressure formulae, energy and temperature, Gas constant and Boltzman's constant, various forms of gas equation.

Work done by expanding gases Cp and by Cv., Isothermal and adiabatic changes, Real gases, critical temperature, van der waal change of state, laws of thermodynamics. Elasticity, strain, stress, moduli of elasticity, Young's sending moments, Hydrostatics, pressure, buoyancy, Archimedes' principles, surface energy, excess pressure, formula, measurement of surface tension by various methods, coefficients, Hydrodynamics: streamlines, Bernoulli and continuity equations, turbulence, Reynolds numbers. Viscosity: Laminar flow: Pineville's formula, measure of coefficient of viscosity, variation with temperature.

## PHY 126: ELECTRICITY AND MAGNETISM (Core, 3 Units)

Electric Field and Electric Potential, Field of force, Electric Field. Electric charge, magnetic Field nuclear field, Electrostatics, Coulomb's law, electric field, Potential energy relations, Gauss theorem, Equipotentials, capacitance, parallel plate and practical forms of capacitors, capacitors in series and parallel, energy stored, dielectrics, action of dielectric charging and discharging a capacitor.

## GST 211 LOGIC AND PHILOSOPHY (Core, 2 Units)

This course covers Philosophical foundations of human existence; main branches of philosophical problems; philosophy and human institutions; science, technology, politics, religions and morality; types and sources of knowledge; facts; Truth, Belief and Opinion; theories of knowledge and philosophy; social and political philosophy; Man-origin, nature and environment; and implication of science, Technology and Education to life.

# MAT 212: LINEAR ALGEBRA I (Core, 2 Units)

Prerequisite: MAT 111, 121

Vector space over the real field, subspaces, linear independence, basis and dimension, linear transformation and their representation, matrices, range, null space rank, singular and non-singular transformation and matrices, algebra of matrices.

# MAT 213: MATHEMATICAL METHODS (Core, 2 Units)

Taylor's series, real valued function of two or three variables, partial derivatives, chain rule, extremes, langrange multipliers, increments, differentials and linear approximations, evaluation of line integrals, multiple integrals.

## STA 217: PROBABILITY II (Core, 3 Units)

Statistical estimation, estimation by methods of moments and maximum likelihood. Some properties of point estimators: unbiasedness, mean square error, sufficiency, efficiency, consistency, Completeness, UMVU, Best asymptotic normal. Cramer-Rao inequalities (lower bound). Interval estimation for means, proportion and their difference. Test of hypothesis, contingency tables and test of independence.

## CPT 211: OBJECT-ORIENTED PROGRAMMING I (Core, 3 Units)

Prerequisite: CPT 121

Overview of programming languages and the compilation process. Introduction to objectoriented programming: Introduction to a typical object-oriented language such as Java; classes and objects; syntax of class definitions; methods, members. Simple data: variables, types, and expressions; assignment. Message passing: Simple methods; parameter passing. Sub-classing and inheritance. Control Structures: iteration, conditionals. Algorithms: problem-solving strategies; the concept of an algorithm; properties of algorithms; implementation strategies. Simple Data structure; Arrays; strings. Object Oriented Design; Fundamental design concept and principles; introduction to design patterns; object oriented analysis and design; design for reuse.

## CPT 212: HARDWARE SYSTEM AND MAINTENANCE (Core, 2 Units)

Prerequisites: CSC111

Introduction to computer systems: Computer systems parts; maintenance techniques, approaches and tools; diagnostics techniques; system assembly and installation; troubleshooting and repair of computer systems and accessories; portable.

#### **CPT 213: INTRODUCTION TO COMPUTER SYSTEM (Core, 2 Units)**

Introduction: Brief history of computing; the components of computing system. Machine level representation of data: Bits, bytes, and words; numeric data representation and number bases; fixed and floating-point systems; signed and twos complement representations; fundamental operations on bits; representation of nonnumeric data ( character codes, graphical data); representation of records and arrays. Digital logic: Switching circuits; gates; memory. Assembly level machine organization: Basic organization of the von Neumann machine; control unit; instruction fetch, decode, and execution; instruction sets and types (data manipulation, control, I/O); assembly/machine language programming; instruction format, addressing modes; subroutine call and return mechanisms; I/O and Interrupt. Input and Output: simple I/O; files. Basic Computability: Finite- state machines; Turing machines; tractable and intractable problems; incomputable functions; the halting problem; implications of computability.

#### **CPT 214: COMPUTER ARCHITECTURE (3 Units)**

Prerequisite: CPT111

Digital logic: Fundamental building blocks (logic gates, flip-flops, counters, registers, PLA); logic expressions, minimization, sum of products forms; register transfer notation; physical considerations (gate delays, fan-in, fan-out). Memory systems: Storage systems and their technology; coding, data compression, and data integrity; memory hierarchy; main memory

organization and operations; latency, cycle time, bandwidth, and interleaving; cache memories (address mapping, block size, replacement and store policy); virtual memory (page table, TLB); fault handling and reliability. Interfacing and communication: I/O fundamentals; handshaking, buffering, programmed I/O, interrupt- driven I/O; interrupt structures; vectored and prioritized interrupt acknowledgement; external storage, physical organizations, and drives; buses: bus protocols, arbitration, direct-memory access (DMA); introduction to networks, multimedia support raid architectures. Functional organization: implementation of simple data paths; control unit: hard wired realization vs microprogrammed realization; instruction pipelining; introduction to SIMD, MIMD, VLIW, EPIC; systolic architecture; interconnection networks; shared memory systems; cache coherence; memory models and memory consistency. Performance enhancement: RISC architecture; branch prediction; prefetching; Scalability. Contemporary architectures: Hand held devices; embedded systems; trends in processor architecture.

# MAT 222: LINEAR ALGEBRA II (Core, Units)

Pre-requisite MAT111, 112

System of linear equations, change of basis, equivalence and similarity, Eigenvalues and Eigen vectors, minimum and characteristic polynomials of a linear transformation(matrix) Caley-Hamilton theorems, bilinear and quadratic forms, orthogonal diagonalisation, canonical forms.

## MAT 224: DISCRETE MATHEMATICS (Core, 3 Units)

Groups and subgroups; group anions, permutation group, closets, Graphs; Directed and undirected graphs, sub graphs, cycles, connectivity, Application (flow chart) and state transition graphs, Lactics and Boolean Algebra, Finite fields; Mini polynomials. Irreducible polynomials, roots, Application (error correcting codes, sequences generators.

## MAT 225: INTRODUCTION TO NUMERICAL ANALYSIS (Core, 3 Units)

Pre-requisite MAT111, 112

Solution of algebraic and transcendental equations, curve fitting. Error analysis. Interpolation and approximation. Zeros or non-linear equations `in one variable'. Systems of linear equations. Numerical differentiation and integration. Initial value problems for ordinary differential equation.

#### **CPT 221: OBJECT-ORIENTED PROGRAMMING II (Core, 2 Units)**

Review of object-oriented programming: Object-oriented methodology, object-oriented design; software tools. Principles of object-oriented programming: inheritance, class hierarchies; polymorphism; abstract and interface classes; container/collection classes and iterators. Object-oriented design: concept of design patterns and the use of APIs; modeling tools such as class diagrams. CRC cards and UMI use cases. Fundamental computing algorithms: searching, sorting, introduction to recursive algorithms. Event-driven programming: event-handling methods; event propagation; exception handling. Foundations of human-computer interaction: human-centred development and evaluation; principles of good design and good designers; engineering trade-offs; introduction to usability testing. Software engineering issues: tools; processes; requirements; design and testing; design for reuse; risks and liabilities of computer-based systems.

## **CPT 222: DATA STRUCTURES (Core, 3 Units)**

Review of object-oriented design. Fundamental data structures: Primitive types; records; the idea of type abstraction; pointers and references; linked structures; implementation strategies for stacks, queues, and hash tables; implementation strategies for graphs and trees; strategies for choosing the right data structure. Fundamental issues in language design: general principles of language design, design goals, typing regimes, data structures models, control structure models, abstraction mechanisms.

## CPT 223: ALGORITHMS (Core, 3 Units)

Algorithms and problem-solving: the role of algorithms in the problem-solving process; the concept and properties of algorithms; classic techniques for algorithm design and implementation and their place in an object-oriented design; application of algorithm design techniques to a medium-sized project' with an emphasis on formal methods of testing; introduction to basic algorithmic analysis. Recursion: the concept of recursion; implementation of recursion and its relation; recursive specialization of mathematical functions (such as factorial and Fibonacci); simple recursive procedures (Towers of Hanoi, permutations, fractal patterns):; divide-and-conquer strategies; recursive backtracking; introduction to trees and graphs. Software engineering: software project management; building a medium-sized system, in teams, with algorithmic efficiency in mind.

## **CPT 224: ELECTRONIC COMMERCE TECHNOLOGY (Core, 2 Units)**

The Concepts and tools of electronic commerce; technology of the Internet, core network protocols, agents, commerce client technology; survey of technologies used to support all aspects of electronic commerce; structural design of electronic commerce systems; client-server architecture, java Beans, Enterprise Java Beans, Java Sever Pages; characteristics, properties and processing of electronic payment; security; design and implementation issues related to web application for electronic commerce.

# **CPT 311: ORGANIZATION AND DESIGN OF PROGRAMMING LANGUAGES** (Core, 3 Units)

History of programming languages. Brief survey of programming paradigms (distinguishing characteristics, tradeoffs between different paradigms, safety and power of expression and particular language supporting each paradigm) Procedural languages, Object-oriented languages, Functional languages, Declarative, non-algorithmic languages, Scripting languages. The effects of scale on programming methodology. General principles of language design. Design goals. Typing regimes( Data type as set of values with set of operations, Data types, Elementary types, user-defined types, Abstract data types). Data structure models, Abstraction mechanisms (Procedures, functions), Control structure models, specifications and their implementations.

#### CPT 312: PROGRAMMING LANGUAGE TRANSLATION (Core, 3 Units)

Introduction: the role of language translation in the programming process. Fundamental issues in language design: general principles of language design; design goals; typing regimes; data structure models; control structure models; abstraction mechanisms. Virtual machines: the concept of a virtual machine; hierarchy of virtual machines; intermediate languages. Introduction to language translation: comparison of interpreters and compilers; language translation phases; machine-dependent and machine-independent aspects of translation; language translation as a software engineering activity. Lexical analysis: application of regular expressions in lexical scanners; hand-coded vs. automatically-generated scanners; formal definition of tokens; implementation of finite-state automata. Syntactic analysis: Formal definition of grammars; BNF and EBNF; bottom-up vs. top-down

parsing; tabular vs. recursive-descent parses; error handling; automatic generation of tabular parsers; symbol table management; the use of tools in support of the translation process.

# CPT 313: OPERATING SYSTEMS (Core, 3 Units)

Overview: Role and purpose of operating systems; history of operating system development; functionality of a typical operating system; design issues (efficiency, robustness, flexibility, portability, security, compatibility). Basic principles: structuring methods; abstractions, processes, and resources; design of application programming interfaces (APIs); device organisations; interrupts; user/system state transitions. Concurrency: the idea of concurrent execution; ststes and state diagrams; implementation structures (ready lists, process control blocks, etc.); dispatching and context switching; interrupt handling in a concurrent environment. Mutual exclusion: definition of the "mutual exclusion" problem; deadlock detection and prevention; solution strategies; models and mechanisms (semaphores, monitors, rendezvous); producer-consumer problems; condition variables. synchronization. multiprocessor issues. Scheduling: prememptive and non-preemptive scheduling policies; processes and threads; real-time issues. Memory management: review of physical memory and memory management hardware; overlays, swapping, and partitions; paging and segmentation; page placement and replacement policies; working sets and thrashing; caching. Device management: characteristics of serial and parallel devices; abstracting device differences; buffering strategies; direct memory access; recovery from failures. File systems: fundamental concepts (data, metadata, operations, organisation, buffering, sequential vs. nonsequential files); content and structure of directories; file system techniques (partitioning, mounting and unmounting, virtual file systems); memory-mapped files; special-purpose file systems; naming, searching and access; backup strategies. Security and protection: overview of system security; policy/mechanism separation; security methods and devices; protection; encryption; recovery management.

## **CPT 314: INTRODUCTION TO WEB DESIGN (Core, 2 Units)**

#### Prerequisites: CSC 111

Introduction to the internet and web servers; the web environment, authoring tool: HTML overview, structural HTML tags, formatting text, creating links, adding images and other page elements, tables, frames, forms, specifying colour in HTML, cascading style sheets, server side include; graphics GIF, JPEG, PNG formats, designing graphics with palette, animated GIFs, multimedia and interactivity, introduction to JavaScript, DHTML, XML, XHTML, WAP and WML.

## CPT 316: SYSTEMS ANALYSIS AND DESIGN (Core, 3 Units)

Introduction and overview. Systems development and the systems analyst. Systems developmet methodologies, models, tools and techniques. Project management and the Unified Process. The requirements discipline. Detailed requirements modeling. Design activities and environments. Use case realization. System access. Implementation.

## CPT 317: DATA COMMUNICATION AND NETWORKS I (Core, 3 Units)

Introduction to Digital and Analogue representations and channels: bandwidth and noise: channel capacity: Nyquist, Shannon: telecommunication history; circuit switching and packet switching; multiplexing; FDM, TDM, statistical multiplexing; virtual circuits and datagrams; Aloha, CSMA, CSMA-CD, token passing, CDMA, wireless LANs and simple performance analysis; errors, coding and redundancy; hamming theory and codes; CRCs, selective retransmission and flow control. Architecture for networks and distributed systems: introduction to LANs and WANs; layered protocol design, ISO/OSI, IEEE 802; impact of architectural issues on distributed algorithms; network computing; distributed multimedia.

Concurrency: states and state diagrams; structures; dispatching and context switching; the role of interrupts; concurrent execution; the "mutual exclusion" problem and some solutions; deadlock; models and mechanisms; producer-consumer problems and synchronization; multiprocessor issues.

Introduction to Computer Networks; The OSI and TCP/IP models; transmission media; network services and protocols; routing protocol and algorithms; network layers and topologies; applications and security; internetworking and the internet congestion and intrusion bandwidth allocation; construction and installation of networks

## CPT 318: INTRODUCTION TO THE WORLD-WIDE WEB (Core, 3 Units)

Introduction to the Internet: Background and history of networking and the \internet; overview of network architectures. Communication and networking: overview of network standards and protocols; circuit switching vs. packet switching. Introduction to the World-Wide Web: web technologies; the HTML protocol; the format of a web page; support tools for web site creation. Multimedia data technologies: sound and audio, image and graphics, animation and video, input and output devices; tools to support multimedia development. Interactivity on the web: scripting languages; the role of applets. Human-computer Interaction: HCI aspects of web-page design; graphical user interface design. Network management: overview of the issues of network management; use of passwords and access control mechanisms; domain name and name services; issues for Internet service providers; security issues and firewalls. Compression and decompression: analogue and digital representations; overview of encoding and decoding algorithms; lossless and lossy compression. Network security: fundamentals of cryptography; secret-key algorithms; public key algorithms; authentication protocols; digital signatures; examples. Software tools and environments: web-page development tools. Intellectual property: foundations of intellectual property; copyrights, patents, and trade secrets; issues regarding the use of intellectual property on the web. Privacy and civil liberties: ethical and legal basis for privacy protection; freedom of expression in cyberspace; international and intercultural implications.

## GST 311: ENTREPRENEURSHIP I (Core, 2 Units)

Historical background of Entrepreneurship in Nigeria to NEEDS and SMEDAN; Macroeconomic framework i.e. monitoring current economic condition and measuring the quality of life of citizens; Conceptual framework on entrepreneur, entrepreneurial, entrepreneurship, interpreneurship, innovation and small scale business; characteristics and quality of entrepreneur, problems and prospects of entrepreneurship; Forms o business ownership; Indigenisation, privatization, commercialization and public-private partnership; Opportunities, planning and launching of small scale business; Management of the small scale business; Inventory control and marketing management practices; Financial management, records and financial institutions; Risk management, insurance, and industrial associations; Tips for breakthrough.

## CPT 321: COMPUTER GRAPHICS (Core, 3 Units)

Graphic systems: Raster and vector graphics systems; video display devices; physical and logical input devices; issues facing the developer of graphical systems. Fundamental techniques in graphics: hierarchy of graphics software; using a graphics API; simple colour models; homogeneous coordinates; affine transformations; viewing transformation; clipping. Graphical algorithms: line generation algorithms; structure and use of fonts; parametric polynomial curves and surfaces; polygonal representation of 3D objects; parametric polynomial curves and surfaces; introduction to ray tracing; image synthesis, sampling techniques, and anti-aliasing; image enhancement. Graphical user-interface design: choosing

interaction styles and interaction techniques; HCI aspects of interface design; dynamics of colour; structuring a view for effective understanding. Graphical user-interface programming: graphical widgets; event management and user interaction; GUI builders and programming environments. Computer animation: key-frame animation, camera animation; scripting system; animation of articulated structures; motion capture; procedural animation; deformation. Multimedia techniques: sound, video, and graphics; design of multimedia systems; tools for multimedia development; virtual reality.

# **CPT 322: INTRODUCTION TO DIGITAL DESIGN AND MICROPROCESSORS** (Core, 3 Units)

Background: history of digital computers; description of a typical integrated circuit. Fundamental Logic Gates: overview of logic circuits and truth tables; the AND gate; the OR gate; the NOT gate. Logic circuit design: addition of logic expressions; truth table representation; diagrammatic representation of logic circuits. Further logic gates: NAND gate, NOR gate; XOR gate. Boolean algebra: switching algebra; basic laws of Boolean algebra; simplifying Boolean expressions, use of truth tables. Karnaugh maps: use of Karnaugh maps; how to use Karnaugh maps; rules of symmetry for Karnaugh maps; three and two variable Karnaugh maps. Further electronic logic: decoders and encoders. Further computer arithmetic: the full adder; parallel addition of binary numbers; serial addition of binary numbers. Flip flop circuits: the S-R flip flop; the J-K flip flop; shift registers. Binary counters.

## CPT 323: AUTOMATA, COMPUTABILITY AND COMPLEXITY (Core, 2 Units)

Finite automata, Regular languages, Regular expressions: deterministic finite automata; nondeterministic finite automata; regular expressions and FA-recognisable languages; non-regular languages; algorithms that answer questions about FAs and regular expressions. Computability theory: Turin machines, nondeterministic Turin machines; undecidability, PCP; counter and stack machines; reducibility; recursion theorem. Complexity Theory: time complexity; nondeterministic time complexity; P and NP; NP-completeness III; poly-time reductions; Cook-Levin theorem; NP-completeness II; space complexity III; probabilistic complexity; probabilistic complexity and interactive proofs.

## CPT 324: INFORMATION MANAGEMENT (Core, 2 Units)

Overview of information management: history and motivation for information systems; common problems of information management; the business perspective. Social issues in information technology: Intellectual property; computer crime; privacy; security and civil liberties; the need for a legal and ethical framework; guidelines for computer use. Introduction to database systems: History and motivation for database systems; components of database systems; DBMS functions; database architecture and data interdependence; use of a database query language; the relational model. Building databases: Underlying methodology; database query languages; particular database issues. Information systems to serve particular purposes: Intranets and extranets; the information retrieval problem. Design and development of information systems: database design; relational database design; lifecycle issues. Security and control issues: overview of problems and standard solutions; database integrity; transactions; the role of encryption. Evaluation of information systems.

## CPT 325: DATABASE DESIGN AND MANAGEMENT (Core, 2 Units)

Information models and systems: history and motivation for information systems; information storage and retrieval; information management applications; information capture and representation; analysis and indexing; search, retrieval, linking, navigation; information

privacy, integrity, security and preservation; scalability, efficiency and effectiveness. Database systems: history and motivation for database systems; components of database systems; DBMS functions; database architecture and data independence. Data modeling: data modeling; conceptual models; object-oriented model; relational data model. Relational databases: mapping conceptual schema to a relational schema; entity and referential integrity; relational algebra and relational calculus. Database query languages: overview of database languages; SQL; query optimization; 4<sup>th</sup> generation environments; embedding non-procedural queries in a procedural language; introduction to Object Query Language. Relational database design: database design; functional dependency; normal forms; multivalued dependency; joint dependency; representation theory. Transaction processing: transactions; failure and recovery; concurrency control. Distributed databases: distributed data storage; distributed query processing; distributed transaction model; concurrency control homogeneous and heterogeneous solutions; client-server. Physical database design: storage and file structure; indexed files; hashed files; signature files; b-trees; files with dense index; files with variable length records; database efficiency and tuning.

## CPT 327: DATA COMMUNICATION AND NETWORK (Core, 3 Units)

Scheduling and dispatch: review of processes and scheduling; deadlines and real-time issues. Real-time and embedded systems: process and task scheduling; memory/disk management requirements in a real-time environment; failures, risks and recovery; special concerns in real-time systems. Fault tolerance: fundamental concepts; spatial and temporal redundancy; methods used to implement fault tolerance; examples of reliable systems. System performance evaluation: why system performance needs to be evaluated; what is to be evaluated; policies for caching, paging, scheduling, memory management, security, etc; evaluation models; how to collect evaluation data. Scripting and the role of scripting languages; basic system commands; creating scripts, parameter passing; executing a script; influences of scripting on programming. Communication and networking: network standards and standardization bodies; the ISO 7-layer reference model in general and its instantiation in TCP/IP; circuit switching and packet switching; streams and datagrams; physical layer networking concepts; data link layer concepts; internetworking and routing; transport layer services. The web as an example of client-server computing: web technologies; characteristics of web servers; role of client computers; nature of the client-server relationship; web protocols; support tools for wed-site creation and web management; developing Internet formation servers; publishing information and applications. Building web applications: protocols at the application layer; principles of web engineering; databasedriven web sites; remote procedure calls; lightweight distributed objects; the role of middleware; support tools; security issues in distributed object systems; enterprise-wide webbased applications. Network management: review of the issues of network management; issues for Internet service providers; security issues and firewalls; quality of service issues. Compression and decompression: review of basic data compression; audio compression and decompression; image compression and decompression; video compression and decompression; performance issues.

## CPT 327: COMPUTER AND NETWORK SECURITY (Core, 2 Units)

## Prerequisites: Computer Networking

Introduction, threats, risks and vulnerabilities, data security, policies/administration, security procedural control, security models, designing secure systems, effects of hardware on security, operating systems security, network security, database security, programming language security, cryptography, distributed systems security and information systems security.

## CPT 328: PROGRAMMING LANGUAGE TRANSLATION II (Core, 3 Units)

Models of execution control: order of evaluation of subexpressions; exceptions and exception handling; runtime systems. Declaration, modularity, and storage management: declaration models; parameterization mechanisms; type parameterization; mechanisms for sharing and restricting visibility of declarations; garbage collection. Type systems: data type as set of values with set of operations; data types; type checking models; semantic models of user-defined types; parametric polymorphism; subtype polymorphism; type-checking algorithms. Interpretation: iterative vs. recursive interpretation; iterative interpretation of intermediate code; intermediate representations; implementation of code generators; code generation by tree walking; context-analysis; loop optimizations; machine-dependent optimization.

## CPT 411: NET-CENTRIC COMPUTING (Core, 3 Units)

Communication and networking: network standards and standardization bodies; the ISO 7layer reference model in general and its instantiation in TCP/IP; circuit switching and packet switching; streams and datagrams; physical layer networking concepts; data link layer concepts; internetworking and routing; transport layer services. The web as an example of client-server computing: web technologies; characteristics of web servers; role of client computers; nature of the client-server relationship; web protocols; support tools for wed-site creation and web management; developing Internet formation servers; publishing information and applications. Building web applications: protocols at the application layer; principles of web engineering; database-driven web sites; remote procedure calls; lightweight distributed objects; the role of middleware; support tools; security issues in distributed object systems; enterprise-wide web-based applications. Network management: review of the issues of network management; issues for Internet service providers; security issues and firewalls; quality of service issues. Compression and decompression: review of basic data compression; audio compression and decompression; image compression and decompression; video compression and decompression; performance issues.

Multimedia data technologies: review of multimedia technologies; multimedia standards; capacity planning and performance issues; input and output devices; MIDI keyboards, synthesizers; storage standards; multimedia servers and file systems; tools to support multimedia development. Wireless and mobile computing: overview of the history, evolution and compatibility of wireless standards; the special problems of wireless and mobile computing; wireless local area networks and satellite-based networks; wireless local loops; mobile Internet protocol; mobile aware adaptation; extending the client-server model to accommodate mobility; mobile data access; the software packages to support mobile and wireless computing; the role of middleware and support tools; performance issues; emerging technologies.

## CPT 412: INFORMATION SYSTEMS (Core, 2 Units)

Introduction to software architecture. Design patterns. Object-oriented modeling and architectural design with contemporary notation. Experimentation in design. Design prototyping. Working on design teams nd management of object-oriented projects. Detailed design and implementation issues. Design reviews. Using design document for coding.

#### CPT 413: SYSTEM OPERATION RESEARCH (Core, 3 Units)

The nature of operation research; allocation problems; inventory problems; Replacement; maintenance and reliability problems. Dynamic programming; sequencing and co-ordination.

## CPT 414: DESIGN AND ANALYSIS OF ALGORITHMS (Core, 2 Units)

divide-and-conquer; backtracking; branch-and-bound; heuristic; pattern matching and string/text algorithms; numerical approximation. Fundamental data structures: implementation strategies for graphs and trees; performance issues for data structures. Graph and tree algorithms: depth- and breadth-first traversals; shortest-path algorithms (Dijkstra's and Floyd's algorithms); transitive closure (Floyd's algorithm); minimum spanning tree (Prim's and Kruskal's algorithms); topological sort. Automata theory: finite-state machines; Turin machines; context-free grammars; uncomputable functions; the halting problem; implications of uncomputability.

## **CPT 415: COMPILER CONSTRUCTION (Core, 3 Units)**

Introduction: Definition of a compiler, compiler applications, phases of a compiler, challenges in compiler construction, compilation process; Lexical Analysis: Role of Lexical Analyzer, Specification of Tokens, Token Recognition, RE to NFA, Lexical Analysis Tool – Lex/Flex/JFlex; Syntax Analysis: Roler of Parser, Error Handling, Grammar, Top-Down Parsing, Bottom-Up Parsing, LR Parsing; Type Checking: Static vs. Dynamic Checking, Type Expressions, Type Checking, Type Equivalence, Type Conversion; Symbol Tables: Information in Symbol Table, Features of Symbol Tables, Simple Symbol Table; Intermediate Code Generation: Intermediate Languages, Intermediate Language Design Issues, Intermediate Representation Techniques; Target Code Generation: Factors Affecting Code Generation: Need for Optimization, Problems in Optimizing compiler Design, Classification of Optimization, Factors Influencing Optimization.

# **CPT 416: SOFTWARE DEVELOPMENT DESIGN TECHNIQUES AND MANAGEMENT (Core, 2 units)**

Software development techniques: Object-oriented analysis and design; component level design; software requirements and specifications; prototyping; characteristics of maintainable software; software reuse; team management; project scheduling Using application programmer interfaces (APIs): API programming; class browsers and related tools; programming by example; debugging in the api environment; component-based computing Large-system engineering: Separate compilation; design issues; verification and validation; integrating components; documentation. Client-server computing: Software support needed for client and server implementation; varieties of server structures; strategies for client-server design; tools for client-server system development; middleware. The web as an example of client-server computing: Web technologies; characteristics of web servers; role of client computers; the applet concept.

## **CPT 417: COMPUTER ETHICS (Core, 2 Units)**

Social context of computing: introduction to the social implications of computing; social implications of networked communication; growth of, control of, and access to the Internet; gender-related issues; international issues. Methods and tools of analysis: making and evaluating ethical arguments; identifying and evaluating ethical choices; understanding the social contest of design; identifying assumptions and values. Professional and ethical responsibilities: community values and the laws by which we live; the nature of professionalism; various forms of professional credentialing and the advantages and disadvantages; the role of the professional in public policy; maintaining awareness of consequences; ethical dissent and whistle-blowing; codes of ethics, conduct and practice; dealing with harassment and discrimination; "acceptable use" policies for computing in the workplace. Risks and liabilities of computer-based systems: historical examples of software risks; implications of software complexity; risk assessment and management.

## **CPT 418: CLOUD COMPUTING**

Overview of Cloud Computing, Definition of Cloud computing. Cloud computing models. Secure outsourcing.Secure computation outsourcing. Proof data of data possession/retrievability. Virtual machine security. Trusted computing technology and clouds. Cloud-centric regulatory compliance issues and mechanisms. Business and security risk models. Applications of secure cloud computing. Attacks, Vulnerabilities, and Enemies: Modeling threats in a cloud. Topology Attacks on Clouds. Proofs of Data Possession and Retrievability. How to secure clouds? Verifying Computations in Clouds. Cloud Forensics. Verifiability of Data in clouds. Availability and Integrity in Clouds. Securing MapReduce. Cloud computing models: software as a service (SaaS), platform as a service (PaaS), infrastructure as a service (laaS) and database as a service. Market overview of cloud providers including Amazon Web Services, Microsoft Azure, Google, RightScale, CloudSigma, GoGrid and Force.com. Strategic technology choices and development tools (including Eclipse and other IDEs, Heroku, Force.com and Elastic Beanstalk) for basic cloud application building. Web-scale analytics and frameworks for processing large data sets using Hadoop and MapReduce. Advanced topics including database query optimization, consideration of NoSOL solutions, memory caching, fault tolerance and disaster recovery

## CPT 511: DATA WAREHOUSING (Core, 2 units)

Prerequisites: CPT 325: Database Design and Management

Data Warehousing: Introduction, What is Data Warehousing, Data Warehousing concepts, Methodology for Data Warehousing, Issues in Data Warehousing, Benefits of Data Warehousing. Data Warehouse Building Blocks: Defining features, Data Warehouse and Data Mart, Overview of the components. Metadata: abstraction, Use of metadata in Data Warehouse, Tools for metadata. Data Design and Data Preparation; ETL Overview: Data Extraction, Data Transformation, Data Loading. Data Quality: Why is data quality critical, Challenges, Tools OLAP in the Data Warehouse: Demand for OLAP - Major features and Functions (Drill-down, Rollup, Slice, Dice), OLAP Models - OLAP Tools - Web OLAP approaches - OLAP Engine Design.

## CPT 512: GRID COMPUTING (Core, 2 units)

Introduction to distributed and high-performance computing. Basic terms: distributed computing, HPC, HPCC, network computing, Internet computing, cluster, grid, meta-computing, middleware, etc; milestones of the history, some representative applications

Classification: Taxonomies, MPP, SMP, CC-NUMA, cluster: dedicated high performance (HP), high availability (HA), CoPs, PoPs, CoWs; distributed, on-demand, high-throughput, collaborative, data-intensive computing.Basics of communication media and protocols: TCP/IP, Internet2, QoS, ATM, Fast Ethernet, etc. Programming models: Message passing, client-server, peer-to-peer, broker computing, code shipping, proxy computing, mobile agents. Toolkit and OO systems. Higher level communication: Light-weight communication, sockets, standard APIs, active messages. Storage and file problems: Network RAM, RAID and software RAID. Distributed File systems: NFS, AFS, OSF-DSF, RSF. Message passing standards: PVM (Parallel Virtual Machine), MPI (Message Passing Interface). Object-oriented de facto standards CORBA and DCOM

Java-based methods: JVM, RMI, Bytecode, Applet and Servlet, JavaBean and JavaSpaces, Jini. Grid toolkit approach: Globus Hourglass concept, communication, resource and process management, data access, security. Object-oriented approach: Legion Language support, component wrapping, program support, resource management. Security: Confidentiality, integrity and availability. Authentication, authori-zation, assurance, auditing, accounting.

Scheduling: Algorithms, policies and techniques, high performance and high throughput schedulers, resource scheduling

Grid monitoring: Tasks, types, architecture, components.

#### CPT 513: SYSTEMS MODELLING AND SIMULATION (Core, 2 Units)

The concept and techniques used in modeling and simulation methodology and a suitable simulation languages, modeling, generation of random variables, transformation of random numbers, parameter estimation design experiment, factorial optimization.

# **CPT 514: SOFTAWRE TESTING VERIFICATION AND VALIDATION (Electives, 2** units)

#### Prerequisites: CPT 517: Software Engineering

Overview of Software Testing, Verification and Validation ; testing fundamentals, including test plan creation and test case generation; black-box and white-box testing techniques; unit, integration, validation, and system testing; object-oriented testing; inspections; Static approaches and dynamic approaches of testing; Different kinds of testing – human computer interface, usability, reliability, security; Defect seeding ; systems testing ; validation planning; documentation for validation; Measurements: process, design, program; Verification and validation of non-code (documentation, help files, training materials); Fault logging, fault tracking and technical support for such activities ; Regression testing• Inspections, reviews, audits

#### CPT 515: ARTIFICIAL INTELLIGENCE (Core, 3 Units)

Fundamental issues in intelligent systems: history of artificial intelligence; philosophical questions; fundamental brute-force search; best-first search; two-layer games; constraint satisfaction. Knowledge representation and reasoning: review of propositional and predicate logic; resolution and theorem proving; nonmonotonic inference; probabilistic reasoning; Bayes theorem. Advanced search: genetic algorithms; simulated annealing; local search. Advanced knowledge representation and reasoning: structured representation; nonmonotonic reasoning; reasoning on action and change; temporal and spatial reasoning; uncertainty; knowledge representation for diagnosis; qualitative representation. Agents: definition of agents; successful application and state-of-the-art agent-based systems; software agents, personal assistants, and information access; multi-agent systems. Machine learning and neural networks: definition and examples of machine learning; supervised learning; unsupervised learning; reinforcement learning; introduction to neural networks. AI planning systems: definition and examples of planning systems; planning as search; operator-based planning; propositional planning.

#### CPT 516: ADVANCED DATABASE SYSTEMS (Core, 2 Units)

Relational data models: relational constraints and relational algebra. Structured query language relational database standard. Case studies: ORACLE/SQL, server/Microsoft Access

#### CPT 517: SOFTWARE ENGINEERING (Core, 3 Units)

Foundations of human-computer interaction: human-centred development and evaluation; human performance models; accommodating human diversity; principles of good design and good designers; engineering trade-offs; introduction to usability testing. Software processes: software life-cycle and process models; process assessment models; software process metrics. Software requirements and specifications: requirements elicitation; requirements analysis modeling techniques; functional and nonfunctional requirements; prototyping; basic concepts of formal specification techniques. Software design: fundamental design concepts and

principles; design patterns; software architecture; structured design; object-oriented analysis and design; component level design; design for reuse. Software validation: Validation planning; testing fundamentals, including test plan creation and test case generation; blackbox and white-box testing techniques; unit, integration, validation, and system testing; objectoriented testing; inspections. Software evolution: software maintenance; characteristics of maintainable software; reengineering; legacy systems; software reuse. Software project management: team management; project scheduling; software measurement and estimation techniques; risk analysis; software quality assurance; software configuration management; project management tools.

## CPT 518: ENTREPRENURSHIP II (Core, 2 units)

Start your digital business: your money making strategies, branding, getting an internet presence, registering your company; the business; market research, preparing your business plan, types of companies, advertising and marketing: the internet ;putting the internet to work for you. Setting up your website, advertising on the Internet; finance for start-ups; venture capital, understanding financial statements, planning and forecasting, taxation accountancy software; the law: company law; software law, confidential information, copyright, trademarks, patents. Successful proposal strategies for small business using knowledge management

## CPT 510: REAL-TIME SYSTEMS (ELECTIVE, 2 Units)

Prerequisites: CPT 313: Operating system

Examples of real time computing systems; real time scheduling and resource management algorithms; analytical and efficient validation methods; example of real time operating systems; temporal consistency of real time data; formal methods for specification of and reasoning about timing constraints.

#### **CPT 521: SYSTEM PERFORMANCE EVALUATION (Core, 2units)**

Prerequisites: CSC 313:Operating System

Introduction and overview, performance modeling; measurement techniques, on-chip performance monitoring, off-chip hardware monitoring, software monitoring, microcoded instruction. Aggregating performance metrics over a benchmark suite, statistical techniques for computer performance analysis, statistical for processor and cache simulation, statistical simulation, benchmark simulation.

#### CPT 522: DATA MINING (Core, 2 Units)

Prerequisites: CSC 325: Database Design and Mgt, CPT 511: Data warehousing.

Data Mining; Data Mining Functionalities; Classification of Data Mining Systems; Data Mining Task Primitives; Integration of a Data Mining System with a Database or Data Warehouse System; Major Issues in Data Mining; Data Preprocessing; Descriptive Data Summarization; Data Cleaning; Data Integration and Transformation; Data Reduction; Data Discretization and Concept Hierarchy Generation.

Data Preparation- Overview, cleaning the data, Removing variables, Data transformation, segmentation; Table and Graphs- Tables, Data tables, Contingency tables; Graphs- frequency polygrams and histograms, scatter plots, box plots, multiple graphs, prediction- classification, Regression, Building a prediction model, applying a prediction model, simple regression models -simple linear regression, simple non linear regression, K-nearest neighbours-learning, prediction, classification and regression trees- predicting using decision trees, neural net; Naive Bayes estimation and Bayesian networks, -Bayesian Approach, Maximum a posterior classification. Posterior odds ratio, Balancing the date, Naive Bayes classification-

numeric predictors analysis using Naive Bayes; Bayesian belief networks, Clotheing purchase example, using the Bayesian Network to find probabilities, Genetic Algorithm Introduction, Basic framework of a GA, simple example of a genetic Algorithm, cross over, multipoint crossriver, uniform crossover, Analysis using Genetic algorithm.

ASSOCIATION RULES AND CLUSTER ANALYSIS: Basic Concepts; Efficient And Scalable Frequent Itemset Mining Methods; Mining; Various Kinds Of Association Rules; Cluster Analysis; Types Of Data In Cluster Analysis; A Categorization Of Major Clustering Methods; Different Clustering Methods. CLASSIFICATION AND PREDICTION: Classification; Issues Regarding Classification And Prediction; Different Classifications; Classification by Decision Tree Induction; Bayesian Classification; Rule Based Classification; Classification by Back propagation; Prediction; Accuracy and Error Measures; Evaluating the Accuracy of a Classifier or Predictor-Ensemble Methods; Model Selection. VARIOUS MININGS: Mining Data Streams; Mining Time; Series Data; Mining Sequence Patterns in Transactional Databases; Mining Sequence Patterns in Biological Data Graph Mining-Social Network Analysis; Multi-Relational Data Mining. MULTIMEDIA MINING AND APPLICATIONS: Multidimensional Analysis and Descriptive Mining of Complex Data Objects; Spatial Data Mining; Multimedia Data Mining; Text Mining; Mining the WWW-Applications and Trends in Data Mining.

## CPT 523: NEURAL NETWORKS (Core, 2 Units)

Overview of neural networks, basic Architecture of neural networks and Neural Computing: central Nervous System: Anatomy and physiology of the brain-Sensation, perception and cognition: learning and memory: Information content of neural signals; spike generation Processes: Stochastically in Neural Codes: Principal components analysis: neural Operators that encode, analyze and represent image structure: Face recognition: Invariants and object representation.

#### CPT 524: EXPERT SYSTEMS (Core, 3 Units)

History of symbolic AI and expert systems. Production systems and methods of inference, resolution theorem proving. Conflict resolution, MYCIN, uncertainty, certainty factors. Fuzzy expert systems. Midterm, frame-based systems. Blackboard systems. Formal ontology in information systems. OWL. Finding out about information retrieval, information extraction and NLP. Future of information technology.

#### **CPT 527: VISUAL BASIC PROGRAMMING (Elective, 3 Units)**

Developing multiplier applications: dividing logical layers into multiple components; implementing components with Visual Basic 2005; reusing components with different UIs; persisting component data into databases. The .NET framework: common language runtime (CLR); framework class library (FCL). Visual Basic 2005 Productivity features: user interface design; VB 2005 enhancements. Object-oriented programming: encapsulation, inheritance; polymorphism. Exceptions and Events: designing and consuming events; structured exception handling. Data manipulation with ADO.NET: the ADO.NET model; programming ADO.NET objects; programming Data Sets and Table Adapters. Deploying Visual Basic. Applications: preparing the release build; comparing X Copy and setup projects; publishing Windows applications with Click Once; harnessing Visual Studio support for Web application deployment.

## CPT 528: INTERNET PROGRAMMING (Elective, 3 Units)

Prerequisites: CPT 314: Introduction to web design, CPT 318: Introduction to WWW.

Overview of Internet, websites and web server; Basic network infrastructure, Choosing a web server and service providers - Understanding the difference between internet and intranet; html and css Introduction to Client-Side Scripting Language: JavaScript. Introduction to Server-side programming Languages: ASP.Net, JSP, PHP. Introduction to PHP: PHP Language; Using PHP; Variables; Program control; Built-in functions; code organization and reuse; Object-oriented programming, moving beyond libraries and Object-Oriented programming, extending objects, working with arrays, strings and characters. Character set and Unicode, interacting with server, redirecting the user; Database basics using MySql, data access, PHP and data access, planning and implementing web applications: cookies and sessions, user authentication, advanced output and output buffering, data validation with regular expression, files and directories; strategies for successful web applications. XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML

## CPT 526: FAULT-TOLERANT SYSTEMS (Elective, 3 Units)

Prerequisites: CSC 313- Operating system

Introduction and overview of fault tolerant schemes; fault and error modeling; test generation and fault simulation; concepts in fault-tolerance; reliability/availability modeling; system level diagnosis; low level fault-tolerance coding techniques (basic principles, parity bit codes, hamming codes, error detection and retransmission codes, burst error correction codes, Reed-Solomon codes. Etc); high-level fault tolerant techniques in systems; rollback, check pointing ,reconfiguration; software fault-tolerance; fault-tolerant routing; integrated hardware/software fault-tolerance; redundancy, spares and repairs apportionment, system versus component redundancy, parallel redundancy, RAID system reliability, N-modular redundancy; software reliability and recovery techniques, network system reliability, reliability optimization.

## **CPT 520: INTRODUCTION TO MOBILE COMPUTING (Core, 3 Units)**

Prerequisites: Computer Networking

Overview of the history, evolution, and compatibility of wireless standards; the special problems of wireless and mobile computing; wireless local area networks and satellite-based networks; wireless local loops; mobile Internet protocol; mobile aware adaptation; extending the client-server model to accommodate mobility; mobile data access; the software packages to support mobile and wireless computing; the role of middleware and support tools; performance issues; emerging technologies.

#### **CPT 419: SEMINAR IN COMPUTER SCIENCE (Core, 2 Units)**

This course entails active participation on current trends that focus on several topical issues in the different areas of the Computer Science Applications.

#### **CPT 519: PROJECT (6 Units)**

Project 100 Marks. This is to be individual or a group project with a maximum of 3 students in one group. The project can be an in-house project. (Project done within one's institution) or it can be done in the industry. In case the project is in an industry the group will be guided by an External Project guide (from industry) and Internal Project Guide (from the institution). In case the project is in-house, the group will be guided by the Internal Project guide. Distribution of marks

Item	Marks	How to Conduct Exam
Project report	50	Assessed jointly by Internal and External
		examiners.
Oral Presentation	50	Assessed jointly by Internal and External
		examiners.

## INDUSTRIAL TRAINING

At the end of first semester, 400 level students in the programme are expected to proceed on twenty-four weeks of student industrial work experience scheme (SIWES); which is to be done in an establishment that can provide relevant industrial experience to the students.

## **FACILITIES REQUIRED**

University Library: The University library is the main source of literature for students of the Computer Science Department.

Departmental Library: Computer Science Department intends to operate its own Library with specialized current collection to provide to the needs of the lecturers and students in research and teaching. It will be equipped with Intranet connectivity and database technology, in sharing of resources and storing of records generated during teaching and research

Computer Laboratory: The Department requires a well equipped and functional Computer laboratory with Local Area Network and Internet connectivity. The laboratory will be divided into software and hardware laboratories. It will be furnished with dedicated softwares and current technologies in all aspects of computing. The laboratory will be used for practical classes and seminars.

#### **DEGREE AWARDED**

The nomenclature of the degree awarded by the Department is Bachelor of Technology (Computer Science).

#### **CLASS OF DEGREE**

The class of degree obtained at the end of the undergraduate programme, is classified as follows:

CGPA	CLASS OF DEGREE
4.50 - 5.00	First Class
3.50 - 4.49	2 <sup>nd</sup> Class Upper
2.40 - 3.49	2 <sup>nd</sup> Class Lower
1.50 - 2.39	Third Class
1.00 - 1.49	Pass
0 - 0.99	Fail

#### **GRADING SYSTEM**

The Federal University of Technology, Minna operates a 5-point grading system. The letter grades in use are:

Letter	Grade	Score (Marks)	Grade Point
А	Excellent	70 - 100	5
В	Very Good	60- 69	4
С	Good	59 - 59	3
D	Intermediate	45 - 49	2
Е	Fair	40 -44	1
F	Failure	0 - 39	0

## CALCULATION OF GRADE POINT AVERAGE (GPA)

At the end of each semester a students' grade point average is calculated to show how the student has performed in that semester. A GPA is derived by determining credit units and grade points and dividing by total credit units.

## CALCULATION OF CUMMULATIVE GRADE POINT AVEDRAGE (CGPA)

A series of GPA's weighted and averaged together over a number of semesters shall constitute the student's cumulative GPA. Cumulative GPA gives an indication of how the student has performed at the end of each session and also at any point in time during his/her academic period.

#### MODE OF EXAMINATION

The following three types of assessment may be used to examine a course in Computer Science:

- 1. Practical examination
- 2. Oral examination
- 3. Written examination/E-examination

The particular mode of examination or combinations chosen shall be dictated by the type of course and shall be the prerogative of the lecturer and the Department.

#### **CARRYOVER COURSE**

No student is allowed to carry over any course in which he scored an "E" grade or above. Both the old and new grades in a carryover course shall be retained in the student's transcript and they will also be used in computing his/her CGPA.

#### DEAN'S LIST, PROBATION AND WITHDRAWAL

Any student that registers a CGPA of 4.0 and above in any session shall qualify to be on the Dean's list of exceptional students. A letter shall be issued from the Dean's Office to inform the student. Any student that gets a CGPA below 2.0 at the end of 100 level session, will be withdrawn from the Department while a student in other level is placed on probation at the first instance and withdrawn at the second time.

#### **COURSE REGISTRATION**

The level adviser for each level is also the registration officer for that level. Every course is assigned a credit load that corresponds with the number of lecture hours per week required to

complete the course during the semester. A course that requires two hours of lectures per week shall be assigned two credit units.

Students are expected to register the courses they are to offer in a particular semester/session. Carry over courses are registered first before the semester courses. The maximum credit unit a student is allowed to register for in a semester/session is 24 credit units and a minimum of 15 credit units would be allowed in any semester. This means that the total number of credit units for all courses registered for by any student during a semester will not exceed 24 or be below 15 units.

## STAFFING

The Department has human resources grouped under academic staff (core staff on the ground for the programme and staff available for the programme from other sources such as Engineering and Science); non-academic staff (made up of secretary, clerical staff, and cleaners), and technical staff (system analyst, programmer, technologist, and technical assistants).

## ORGANIZATIONAL CHART OF THE DEPARTMENT

The Department is headed by the Head of Department (HOD) who assigns duty and responsibilities to staff. The Departmental activities are guided by the regulations approved by the University Senate and supervised by the Dean of School. The organisation structure is shown in Figure 1. The department uses committee system with departmental board as its highest decision making body after the committees. The HOD chairs all the meetings of the Departmental Board while the Secretary who is appointed from the members of academic staff takes the minutes, prepares and circulates it in readiness for the next meeting. He/she is assisted by another staff. The department staff are involved in any decision concerning issues affecting the department through participation at departmental meetings where these issues are deliberated on and suggestions made. The meeting considers and approves course allocations to academic staff, examination schedule and procedures, examination results, research areas and other matters concerning the department.



Figure 1: Organizational chart of Computer Science

Some of the departmental committees are admission committee, research committee, finance committee, staff appraisal committee, curriculum review committee, welfare committee, strategic planning committee, etc.