SYNOPSIS OF COMPUTER COURSES OFFERED IN THE DEPARTMENT

A. Computer Science Courses

CSC 101: Introduction to computer Science 2 Units

CSC 201: Computer Programming I 3 Units
Introduction to problem solving methods and algorithm development, designing, coding, debugging and documentation programmes using techniques of a good programming language style. Computer organisation, programming language and programming algorithm development. Principles of good programming. Structured programming concepts, testing, string processing, interval searching and sorting, data structure, recursion.

CSC 202: Computer Programming II 3 Units

CSC 203: Discrete Mathematics 3 units

CSC 210: Computer Operating System I 3 Units

CSC 212: Computer Networks 2 units

CSC 301: Assembly Language Programming 3 Units
Binary number systems and other systems, types of encoding, mode of representation of data e.g. integer, floating packaged decimal, characteristics, basic structure of the computer instruction set
and corresponding machine language, modes of addressing, instruction execution and flow of control, programming in assembly language, input and output, subroutines and central section’s macros, linkages interfacing, assembly language programs with program in other language; necessary aspect of job control language.

**CSC 303: Data Structure and Algorithms** 3 Units
Abstract Data Structures such as Arrays, Queues, Stacks, Heap, Linked list. Trees.
Sequential and linked implementation of stacks and queues.
Sorting Algorithms: Selection sort, bubble sort, insertion sort, merge sort, quick sort.
Comparison of sorting techniques and analysis.
Searching methods: Sequential and binary, Dynamic programming, Greedy algorithm.
Performance analysis: Space complexity, Time complexity, Big 0 notation, orders of magnitude.
Programming exercises.

**CSC 307: Computer Operating system II** 3 Units
File systems Naming, structure, types, access, attributes and operation; memory mapped directories: Hierarchical structure, pathnames, operations, implementation, share files, disk space management, file system reliability & performance.
File security: environment, security flaws, and design principles in security, user authentication. Protection mechanism.
Input/output: I/O devices, device controllers, Direct Memory Access (DMA), goals of I/O software. Case study on UNIX, MS-DOS and open systems (LINUX)

**CSC 309: Formal Methods of Software Development** 2 Units
Concepts of formal methods, formal specification language, formulation of formal specification for simple software systems. Creation & evaluation of pre and post assertion in scenarios of varying complexities.
Application of verification techniques to program code. Advantages/Disadvantages of formal specification language.

**CSC 311: Systems Analysis and Design** 2 Units
System concept, organisation of a DP department within system development life cycle(SDLC), feasibility study, projects identification and selection fact-finding and analysis, process of system design, design problem identification, definitions and solution, physical and implementation, data capture, data recording transmission, conversion and possible effect, file design control and security, personnel training, system testing and maintenance, evaluation process system documentation, report writing and representation.

**CSC 315: Computer Applications** 2 Units
Group seminars on computer applications in selected areas. Topics should also cover social, culture, psychological, political, and economic. Consequences of the use and misuse of computers in variety of situation in the society, the future of computers, computer technology and usage.
CSC 317: Computer Graphics  3 Units

CSC 392: Industrial Attachment  6 Units
Every student in the department must undergo an industrial attachment in a place relevant to the student’s area of interest during the long vacation of the penultimate year. Report of the acquired experience will be typed, binded, submitted and presented in form of a seminar at a time to be announced during the first semester.

CSC 398: Seminar  2 Units
Students will give seminar on his industrial attachment (SIWES)

CSC 401: Java Programming  3 Units
Introduction, Applets and oranges, building and running applets; applet syntax, Java building blocks: Object-orientation, Constructors & Destructors, program organisation and packages, Graphics, Components and events; Animation and Threads; Java exceptions and Errors.

CSC 403: Modelling and Simulation  3 Units
The concepts and techniques used in modelling and simulation methodology and a suitable simulation language; Modelling generation of random variables transformation of random numbers, parameter estimation design experiment, factorial design optimisation. Types of models, Markov models/Chains, Queue models, birth and Death process; Poisson process.

CSC 409: Digital Design & computer Architecture  3 Units
Combinatorial logic, sequential logic, micro processing and mini-computer, basic logical design, data representation, instruction formats; computer architecture, study architecture of an actual simple mini-computer.

CSC 411: Organisation of Programming Languages  3 Units
Language definition structure, data types and structures, review of basic data types including lists and trees, control structure and data flow, run-time consideration, interpretative languages, lexical analysis and parsing.

CSC 412: Database Systems Design and Management  3 Units
Basic concept of database, history of DBMS, types of database, specific problems of data independence, data reliability, integrity etc. Data management system, architecture function and components of DBMS environment, hardware, management, database generation, raw data, data definition, data model: network, hierarchical, relational, security policies, privacy quality and integrity protection mechanism, Normalisation.
CSC 414: Microprocessor Architecture 3 Units
Review of basic concepts in digital electronics. Microprocessors: functions; operations, and architecture. Comparisons of current microprocessors; multi-chip. Single chip; I/O organisation, assembly language, comparison of instruction sets; addressing modes; stack operation; subroutines; I/O data transfer; bus control; daisy chaining, handshaking etc. Interrupt structures; programmed transfer; DMA microcomputer system. Types of microprocessors; uses of microprocessors, microcomputer design for specific applications. Microcomputer networking interfacing microcomputer real-time control laboratory exercises using an assembly language.

CSC 415: Artificial Intelligence 3 Units
Introduction to artificial intelligence, understanding natural languages, knowledge representation, expert systems, pattern recognition, the LISP programming language. Neural networks.

CSC 417: Information Theory and Data Communication 3 Units
Historical background of information theory models or computation systems, Coding theory, information and encoding. Basic concept of interactive terminals, devices, protocols, direct link communication channels, telecommunication links, simplex, half duplex, duplex, multiplexes; concentrators, computer networks, operating systems for on-line processing, routing algorithms. Response time reliability and security.

CSC 421: Introduction to Software Engineering 3 Units
Basic concepts, software development activities, software process models, prototyping. Software evaluation. Maturity models.

CSC 427: Web Design and Data Security 3 Units

CSC 428: Theory of Computing 3 Units
Introduction to mathematical theory of automata; computability and recursive function theory, finite state automata and sequential machines relations, synthesis and decomposition, simple theory of Turing machines. The halting problem.

CSC 433: Computer Centre Management 3 Units
Organisational and administrative structure of a computer centre. Types of computer centre. Recruiting techniques in and trends in cost performance, centralised and decentralised facilities – leased versus purchase decisions on hardware; factors affecting make, buy, lease or centralised decisions on software. Selection criteria and performance/prediction methods for evaluating hardware and software.
CSC 499: Project 6 Units
Independent research work in computer science

B. Mathematics Courses

MAT 101: Elementary Mathematics 1 3 Units
The number system: Integers, rational and irrational numbers. Indices surds and logarithms.
Mathematical induction.
Polynomials and Rational Expressions: Simple equations, simultaneous equations, quadratic
equations. The Remainder and Factor Theorems. Cubic and quadratic equations. Partial
fractions.
Sequences and Series: Arithmetic sequences and series, geometric sequences and Series. The
Binomial Theorem.
Matrices and Determinants (man <=3): Notation. Algebra of Matrices, Types of Matrices.
Determinants. Inverse of a matrix. Solution of linear systems of equation.
Complex Numbers: Algebra of complex numbers. Argand diagram. De Moivre’s Theorem and
nth roots of unity.

MAT 102: Elementary Mathematics II 4 units
Coordinate Geometry: The Cartesian Coordinates. Equation of a line, a circle, a parabola, an
ellipse and a hyperbola.
Trigonometry: Circular measure, trigonometric functions of angles of any magnitude. Radian
measure of an angle. Graphs of the trigonometric functions, compound angles, identities, inverse
trigonometric functions, and trigonometric equations.
Calculus:
Differentiation: Differentiation of algebraic functions, the power rule, product rule, chain rule
and quotient rules. The differentiation of trigonometric functions. Higher derivations
Maxima and minima. Applications of differentiation to curve sketching etc
Integration: Integration as inverse of differentiation; definite and indefinite integrals. Techniques
of integration. Applications of integration to areas and volumes.

MAT 104: Vectors 3 Units
Introduction to vectors, vector addition, component of vectors, unit vectors i, j, k. Magnitude of a
vector. Vector multiplication (scalar, vector, scalar triple and vector triple products).
Application to geometry and kinematics, (including relative velocity). Solutions to simple vector
equations. Differentiation and integration of vectors.

MAT 105: Elementary Mathematics for Biological Sciences 1
Elementary set theory. Real numbers. Indices, surds and logarithms. Permutations and
combinations. The Binomial theorems for positive, negative and fractional indices. Solution of
linear and simultaneous equations. Remainder and Factor theorems. Inequalities.
Matrices and Determinants (man<=3): Notation. Algebra of matrices. Simple properties of
determinants. Solution of linear equations in three unknown
Trigonometry: Circular measure. Trigonometric functions of angles between 0° and 360°.
Graphs of trigonometric functions.
Coordinates Geometry: Cartesian coordinates. Equation of a straight line and of a circle.

**MAT 106: Elementary Mathematics for Biological Sciences 11** 3 Units
Integration: Definite and indefinite integrals and their application to areas and volumes.
Differential Equations: First order differential equations with separate variables and applications to first and second order chemical reactions, radio activity and claphegron equation.

**MAT 201: Mathematical Methods 1** 3 Units
Review of calculus, further integration, Reduction formula Tailor’s Series Functions of several variables. Jacobian function, dependence and independence, line integral, multiple integrals, Leibnitz theorem. Total derivatives.

**MAT 202: Introduction to Ordinary Differential Equations** 2 Units

**MAT 203: Linear Algebra 1** 3 units
Linear transformations and matrix representations: Range, null space and rank. Singular and non-singular transformations and matrices. Eigen values and eigenvectors. Diagonalisation. Minimal polynomial

**MAT 204: Numerical Analysis 1** 3 Units

**MAT 205: Abstract Algebra** 3 Units
Sets, Binary operations on sets, Mappings. Cartesian products, Equivalence relations.
Introduction to Number Theory: Divisibility and Primes, fundamental theorem of Arithmetic; Congruences. Linear Congruence Equation. Euler’s Function.
Introduction to Group Theory: Definition and examples of subgroups, Homomorphisms and Isomorphism of Groups. Coset Decomposition, Lagrange’s Theorem.

**MAT 206: Mechanics** 3 Units
Dynamics: Newton’s law, Forces, work, power, energy and momentum. Elastic strings, Hooke’s law, motion in resisting media.
Impulsive Motion: Elastic and inelastic collisions
Coplanar Motion: Energy equation, simple pendulum.

MAT 207: Real Analysis 1 3 Units
Properties of real numbers. Least upper and greatest lower bounds. Convergence and divergence of sequences and series of real numbers.
Real-valued functions: Continuity and differentiability. Taylor’s Series.

MAT 208: Introduction to operation Research 2 Units

MAT 210: Real Analysis II 2 Units

MAT 301: Ring Theory 3 Units

MAT 305: Complex Analysis 1 3 Units

MAT 309: Mathematical methods II 3 Units
Boundary value problem – eigenvectors, linear independence. Wronskian, reduction of order, variation of parameters, series solutions near ordinary and a regular, singular points, special functions. Bessel, Legendre and hyper geometric equations and functions, Gamma and Beta functions. Laplace transforms and applications of initial value problems.

MAT 311: Theory of Modules 2 Units
Modules. Sub modules, quotient modules, isomorphism theorems. Polynomial and power series in several variables, symmetric polynomials. Finitely generated modules over principal ideal
domains with applications to abelian groups. Bilinear and quadratic forms, multilinear algebra, tensor, exterior and symmetric products.

**MAT 313: Numerical Analysis I1**
3 Units

**MAT 315: Vectors and Tensors Analysis**
3 Units

**MAT 317: Metric space Topology**
3 Units

**MAT 321: Linear Algebra II**
2 Units

**MAT 323: Real Analysis III**
3 units

**MAT 392: Industrial Attachment**
6 Units
Every student in the department must undergo an industrial attachment in a place relevant to the student’s area of interest during the long vacation of the penultimate year. Report of the acquired experience will be typed submitted and presented in form of a seminar at time to be announced during the first semester.

**MAT 398: Seminar**
2 Unit
Student will give a seminar on his industrial attachment (SIWES)
MAT 403: Functional Analysis  
3 Units  
A survey of the classical theory metric spaces (including Blaire’s category theorems compactness, separability, isometrics and completions), elements of Banach and Hilbert spaces, parallelogram law and linear spaces into second dual, properties of operators (including the open mapping and closed graph theorem). The spaces C(X), the sequences (Banach) spaces \( l^p \), \( L^p \) and C (spaces of convergent sequences).

MAT 407: Optimisation Theory  
3 Units  
Review of linear programming models. The general non-linear programme; direct search and gradient methods, golden search and Fibonacci methods, conjugate gradient methods of Fletcher, Power and Reeves, cutting place methods unconstrained optimisation, languages multipliers method of constrained optimisation, convex programming, penalty function methods, sequential unconstrained techniques. Kuhn-Tucker theory, quadratic programming algorithms of scale and Wolfe, the complimentary problem.

MAT 409: Mathematical methods 11  
3 Units  

MAT 411 General Topology  
3 Units  

MAT 412: Lebesgue Measure and Integration on IR  
3 Units  
The Lebesque outer measure. Measurable subsets of the real line. The Lebesque integral of non-negative functions, the general integral and convergence theorems, Introduction to \( L^p(E) \) spaces for measurable subsets \( E \) of the real line.

MAT 413: Ordinary Differential Equation  
3 Units  

MAT 414: Partial Differential Equations  
3 Units  
MAT 415: Advanced Algebra I 3 Units

MAT 416: Advanced Algebra II 3 Units

MAT 417: Fluid Dynamics 1 3 Units

MAT 418: Fluid Dynamics 11 3 Units

MAT 419: Complex Analysis II 3 Units

MAT 421: Numerical Analysis III 3 Units
Partial differential equation especially parabolic, elliptic and hyperbolic systems, eigenvalue problems, Fourier and Chebychev methods, optimisation, Monte-Carlo methods. Students will be expected to prepare flowchart, write program in either C or FORTRAN to compute the above.

MAT 422: Calculus of Variation 3 Units
Functional Euler’s equations, problems with moving boundaries, extremes with corners, conditional extreme; principles of least action, isoperimetric problems. Hamilton’s principle, direct methods of Euler, Rits, Kantrivic etc.

MAT 426: Systems Theory 3 Units

MAT 472: Graphs and Matroids 3 Units
Matrix representation of graph, planarity and connectivity, complete graphs, bipartite graphs, diagraphs, gravy-isomorphism, distances in a graph, tournaments, detection of cliques in a communication network, Euler graphs, Hamiltonian circuits, the Konigsberg bridge problem and its generalisations; trees, cycles, cocycles, spanning trees, menger’s theorem, Kuratowski’s
theorem, colourability, graph enumeration, distinct representations, Hall’s theorem, introduction to the theory of matroids.

MAT 498 Project 2 units
Seminar on project

MAT 499 Project 6 units
Independent research work

C. Statistics Courses

STA 101 Elementary Statistics I 2 Units

STA 102 Elementary Statistics II 2 Units

STA 201 Statistics for Non Majors 2 Units

STA 202 Statistical Inference I 2 Units

STA 203 Statistical Computing I 2 Units

STA 204 Introduction to Social and Economic Statistics 2 Units

**STA 205  Probability I**  

**STA 208  Probability II**  

**STA 303  Distribution Theory I**  

**STA 305  Sampling Techniques I**  
Designs of sample surveys: Planning and programming. Procedures and estimation of means, ratios, proportions in simple random, stratified, systematic cluster, sub-stage and probability proportional to size sampling, sampling and non-sampling errors. Illustration with specific Nigeria sample surveys. Regression and ratio and inference estimation procedures.

**STA 307  Regression and Analysis of Variance I**  

**STA 309  Statistical Inference I**  

**STA 311  Statistical Methods I**  
Application of the normal distribution. Statistical tests and procedures. Least squares. Analysis of variance and covariance. Regression and correlation analysis. Polynomials, including
orthogonal fittings. Multiple comparisms. Elements of non-parametric methods and sequential analysis.

**STA 313 Statistical Computing II**  
2 Units  
Use of advanced packages; SAS, TSP, GENSTAT, BMDP, XCONCOR, CENTS, EPI-IFO, ISSA. Analysis of statistical and numerical algorithms. Introduction to Monte Carlo methods.

**STA 317 Biometric Methods I**  
3 Units  

**STA 392 Industrial Attachment**  
6 Units  
Every student in the Department must undergo an industrial attachment in a place relevant to the student’s area of interest during, the long vacation of the penultimate year. Report of the actual experience will be typed, bound, submitted and presented in the form of a seminar at a time to be announced during the first semester.

**STA 401 Probability III**  
3 Units  

**STA 402 Statistical Inference II**  
3 Units  
General linear hypothesis and analysis of linear models. Further treatment of estimation and hypothesis testing extension of uniparameter situation. Basic idea of distribution free statistics.

**STA 403 Distribution Theory II**  
3 Units  

**STA 412 Experimental Design II**  
3 Units  
Further split plot design and nested designs, unbalanced designs, incomplete block designs, \(2^n\) factorial designs, Yale’s-Algorithm confounding and fractional replication. Dialled cross analysis. Introduction to response surface methodology.

**STA 405 Sampling Techniques II**  
3 Units  
Ratio, regression and difference estimation procedures. Interpenetrating scheme Multistage and Multiphase sampling. Cluster sampling with unequal sizes. Problems of optimal allocation with more than one item. Sources of errors in surveys. Double sampling.
STA 406  **Stochastic Processes** 3 Units
Simple and general random walk with absorbing and reflecting barriers, ruin problems, fluctuation in coin tossing, classification of stages, ergodic properties; generating functions, convolutions, first passage times, recurrent events, Markov process with finite chains, processes with independent increments. Poisson, branching, birth and death processes. Kolmogorov equations; queuing processes types and relevant application.

STA 407  **Regression and Analysis of Variance II** 3 Units

STA 408  **Multivariate Methods** 3 Units

STA 409  **Time Series Analysis** 3 Units

STA 410  **Operation Research** 3 Units

STA 411  **Experimental Design I** 3 Units

STA 424  **Non-Parametric Methods** 3 Units
One sample case binomial, chi-square tests for randomized sign test and tests for independence series. Two sample case, median tests, sign test, Wald-Wolfowtx test and Wilcoxon test, K samples case median tests, Krustal-Wallis H Test.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>STA 418</td>
<td>Environmetrics</td>
<td>3</td>
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<tr>
<td>STA 413</td>
<td>Decision Theory</td>
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<td>Principles used in decision making, utility functions and their properties, role of uncertainty. Baye’s strategies with prior and posterior distribution, minimax strategies, statistical inference.</td>
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<td>STA 414</td>
<td>Theory of Games</td>
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<td>General history of two-person zero-sum games, theory of supporting hyperplans, minimax theorem, the fundamental theorem of matrix games, the primal and dual of the game theoretic problem, matrix games and linear programs.</td>
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<td>STA 415</td>
<td>Biometrics Methods II</td>
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<td>STA 416</td>
<td>Econometric Methods</td>
<td>3</td>
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<td>STA 417</td>
<td>Demography</td>
<td>3</td>
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<tr>
<td>STA 421</td>
<td>Statistical Methods II</td>
<td>3</td>
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<td>Control charts for means, standard deviation and ranges. Control charts for number of defectives. Acceptance sampling procedures; single, double and multiple sampling plans. Lot-by-lot sampling inspection by attributes and variables. Continuous sampling plans.</td>
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<td>STA 498</td>
<td>Seminar</td>
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<td>Student will give seminar on his project.</td>
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<td>STA 499</td>
<td>Project</td>
<td>5</td>
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<td>Independent research work in statistics</td>
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**Notes:**
- STA 418: Environmetrics
- STA 413: Decision Theory
- STA 414: Theory of Games
- STA 415: Biometrics Methods II
- STA 416: Econometric Methods
- STA 417: Demography
- STA 421: Statistical Methods II
- STA 498: Seminar
- STA 499: Project