SCHOOL OF SCIENCE AND TECHNOLOGY
PAN-ATLANTIC UNIVERSITY

Programme Manual

B.Sc. Computer Science

SST • School of Science and Technology • Pan-Atlantic University
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1.0 THE MISSION OF THE BSC COMPUTER SCIENCE PROGRAMME

The undergraduate programme in Computer Science is aimed at developing competent, creative, innovative, entrepreneurial and ethically-minded persons, capable of creating value in the diverse fields of Computer science.

2.0 THE PHILOSOPHY OF PROGRAMME

The overall intention is to nurture individuals who are technically skilled, creative, innovative, professionally competent, enterprising, and zealous for the common good, with the ability to make free and morally upright decisions, and who can thus impart positive values in service to society. The programme will provide intensive practical and theoretical courses, which are designed to prepare the students to work in modern day industries as pure and applied Computer Scientists. Career prospects for graduates of this course include computer software design and programming as applied to various fields. The programme will emphasize particularly the need for high ethical standards in the exercise of professional work, training, teaching, and obligations. Hence, the curriculum will be suffused with courses that deal with human values, analytical and critical thinking and the appropriate design and use of computing systems. The programme is largely driven by the need to facilitate, through adequate theoretical and practical training, the emergence of competent professionals in the area of pure and applied computer science. The programme aims to build new generation of computer scientists that can favourably compete with peers from any reputable institutions in the world. As a fundamental principle, the programme emphasizes interactions between the industry players, lecturers and students, with the goal of ensuring relevance to the industry as well as driving the innovation needs of the industry. Together with the technical skills and competencies, the programme also places emphasis on a holistic development of the positive character traits of the students. Such traits could be critical success factors in the team work required for professional success in the workplace.

3.0 GUIDING PRINCIPLES FOR THE PROGRAMME

The following basic points are the guiding principles for the programme:

a) The programme will impart an education that is relevant to the needs of the nation and of international standard. The relevance of the programme's content will be ensured by fostering a strong relationship with the industry.
b) The programme will give particular emphasis to teaching and research. The academic staff will be encouraged to engage in research and attend conferences of relevance across the world. This is expected to ensure a continuous improvement in their teaching and maintain its relevance to the needs of the nation.
c) The programme will be concerned with the integral formation of the individual and will lay special emphasis on the development of values and ideals. Professional ethics will permeate all teaching activities in the programme.

4.0 GOALS OF THE PROGRAMME

The aims and objectives of the programme include but are not limited to the following:

a) Create in students the awareness of and enthusiasm for computer science and its capabilities.
b) Involve the students in an intellectually stimulating and satisfying experience of learning and studying
c) Provide a broad and balanced foundation in computer science knowledge and practical skills.
d) Develop in students through an education in computer science a range of transferable applicable skills of information technology to all aspects of human endeavours.
e) Generate in students an appreciation of the importance of computer in an industrial, economic, technological and social context.
f) Provide students with knowledge and skills base for further studies in computer science or multi-disciplinary studies involving computer science.
g) To offer an integral formation with emphasis on the development of values and ideals that will help prepare the students to play leadership roles in such industries.

5.0 ADMISSION AND GRADUATION REQUIREMENTS

5.1. Admission and Matriculation Requirements

The entry requirements shall be at least credit level passes in five subjects including English Language, Mathematics, and Physics to form the core subjects with credit in any other two relevant science subjects, at the Senior Secondary School Certificate or its equivalent in not more than two sittings. In addition, an acceptable pass (currently 220) in the Unified Tertiary Matriculation Examination (UTME), with relevant subject combination is required for Admission into 100 Level.

Candidates with two A level passes (graded A-E) at the GCE/IJMB Advanced Level in relevant subjects (Chemistry, Mathematics and Physics) may be admitted into 200-level. This is in addition to fulfilling the requirement of a minimum of credit level passes in five relevant subjects at SSCE or WASCE/GCE 'O' Level as indicated above. Other tertiary level qualifications such as OND, HND may be considered for direct entry as well.

5.2. The Semester Course System

The undergraduate programme in Computer Science will be run on the semester course basis, and there will be two semesters in the academic year. Instruction in the programme shall be by courses, and it will be mandatory for students to take an approved combination of courses in any semester.

An evaluation of the courses will be carried out in terms of course units. For this purpose, one course unit is defined as one lecture/seminar/tutorial hour or three hours of practical class per week, for the duration of a semester. Ordinarily, students

shall be expected to register for a prescribed number of units in each academic year. This number will be determined by Senate from time to time, based on the recommendation of the School Board.

There shall be four levels of courses in line with the years of study. The levels shall be numbered respectively as 101-199, 201-299, 301-399 and 401-499. Each of these numbers shall be prefixed by a two or three letter subject code.

Students will be required to complete their registration for the courses within the period stipulated by the School. Amendment of this registration will be allowed through the addition or deletion of courses but it must take place within three weeks of the commencement of lectures.

Direct entry and transfer students that enter into the second year of the programme will have to take some compulsory courses from the first year prior to their graduation from the University. However, if the Faculty Board assesses that a student has done any of the courses elsewhere, such a student will be exempted from taking the course.

5.3. Examinations and Grading System

At the end of each semester, students will be examined on all the courses they have registered for and been taught during that period. They shall subsequently be credited with the number of course units assigned to the courses that they pass.

The assessment of students will be based on a combination of continuous assessment (tests, assignments, etc.) – 30%, class participation – 5% and examinations – 65%. To be eligible to sit for any examinations, students will be expected to attend a minimum of 80% of the lectures of any course registered for. All courses registered for will be taken into consideration during the computation of results. Students will not be credited for courses that they did not register for even if they are inadvertently allowed to take the examinations and pass them.

Failure to take the examination in a course for which one has registered will attract a score of 0.0, which will have the consequent effect of lowering the student's Grade Point Average.

Special examinations to enable a student graduate may in exceptional circumstances be held by order of Senate. Grades will be awarded based on the scores of the students as follows:

Percent Score	Grade point	Letter Grade
70 -100	5.0	A
60 – 69	4.0	B
50 – 59	3.0	C
45 - 49	2.0	D
0 – 44	0.0	F

For the purpose of description, a score below 2.0 Grade Point (from letter grade D) constitutes a failure. The following qualifications shall be applied to the grades:

A	Excellent
B	Good
C	Fair
D	Pass
F	Failed

To obtain the Cumulative Grade Point Average (CGPA) of the student, the grade point assigned to the mark obtained in each course is multiplied by the units of that course. The total from all the courses is added up to give the total weighted grade point. This total is then divided by the total number of units taken by the student to give the grade point average.

5.4. Retention and Progression

To remain in the School, students will be required to ensure that their CGPA does not fall below 1.5. If a student's CGPA falls below 1.5, the student will be placed on probation. If the student fails to improve and, after one semester of probation, his/her CGPA remains below 1.5, that student will be asked to withdraw. A student on probation will not be permitted to register for more than 18 units.

5.5. Period of Study and Requirements for the Award of a Degree

The normal period of study for an honours degree shall be eight semesters for 100 level entrants and six semesters for direct level entrants. In order to be eligible for graduation, the student must pass all the compulsory courses, the minimum number of which is 75 credit units. Additional number of credit units required for graduation will be as stipulated by the Senate of the University. The determination of the class of degree shall be based on the weighted grade points of all the courses taken, including the courses that are repeated. The award of the degree with honours shall be dependent on the student having obtained a Cumulative Grade Point Average of at least 2.0 in addition to fulfilling other minimum requirements for an honours degree. The following classes of degree are approved for the CGPA indicated:

Class of Degree	Cumulative GPA
First Class	4.5 – 5.0
Second Class (Upper Division)	3.5 – 4.49
Second Class (Lower Division)	2.4 – 3.49
Third Class	1.5 – 2.39

The maximum number of semesters for the award of an honours degree shall be ten semesters. A student who spends more time than this to complete the degree programme will ordinarily not be eligible for an honours classification.

5.6. Curriculum for B.Sc. Degree in Computer Science in agreement with the NUC Minimum Standards (2018)

NOTE the following legend for the list of courses below:

C = Compulsory Course – A course which every student must compulsorily take and pass in any particular programme at a particular level of study.

E = Elective Course – A course that students take within or outside the faculty (school). Students may graduate without passing the course provided the minimum credit unit for the course had been attained.

R = Required Course – A course that you take at a level of study and must be passed before graduation

LH = Lecture Hours per semester
PH = Practical Hours per semester

SCHOOL OF SCIENCE AND TECHNOLOGY
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B.Sc COMPUTER SCIENCE PROGRAMME STRUCTURE

FIRST YEAR COURSES

Course Code	Course Title 100 Level First Semester	Units	Status	PREQ	LH	PH
CSC 101	Introduction to Computer Science	3	C	-	30	45
CHM 101	General Chemistry I (Physical)	3	R	-	45	-
CHM 107	General Practical Chemistry I	1	R	-		45
MTH 101	Elementary Mathematics I (Algebra & Trigonometry)	3	R	-	45	-
MTH 103	Elementary Mathematics II (Set Theory and Numbers)	3	R	-	45	-
PHY 101	General Physics I (Mechanics & Properties of Matter)	3	R	-	45	-
PHY 107	General Physics Practical I	1	R	-	-	45
GST 101	Communication in English I	2	C	-	30	-
GST 103	Use of Library, Study Skills and ICT	2	R	-	30	-
GST 108	Introduction to Quantitative Reasoning	2	R	-	30	
	TOTAL UNITS	**23**				

Course Code	Course Title 100 Level Second Semester	Units	Status	PREQ	LH	PH
CSC 102	Introduction to Problem Solving	3	C	-	30	45
PHY 102	General Physics II (Electricity, Magnetism & Modern Physics)	3	R	-	45	-
PHY 108	General Physics Practical II	1	R	-	-	45
MTH 102	Elementary Mathematics III (Differential and Integral Calculus)	3	R	-	45	-
GST 102	Introduction to Christian Theology	3	C	-	45	-
GST 104	Logic, Philosophy & Human Existence	2	C	-	30	-
GST 105	Communication in English II	2	C	-	30	-
GST 125	Contemporary Health Issues	2	R	-	30	
	TOTAL UNITS	**19**				

SECOND YEAR COURSES

Course Code	Course Title 200 Level First Semester	Units	Status	PREQ	LH	PH
CSC 201	Computer Programming I	3	C	CSC 102	30	45
CSC 205	Operating System I	3	C	-	30	45
MTH 201	Mathematical Methods	3	R	-	45	
STA 205	Statistics for Physical Sciences and Engineering	3	R	-	45	-
MTH 203	Linear Algebra I	3	E	-	45	-
PHY 201	General Physics III (Modern Physics)	3	E	-	45	-
ENT 201	Entrepreneurship I	2	C	-	15	45
GST 202	Philosophical Anthropology	2	C	-	30	-
GST 211	Environment and Sustainable Development	2	R	-	30	
	TOTAL UNITS	**24**				

Course Code	Course Title 200 Level Second Semester	Unit	Status	PREQ	LH	PH
CSC 202	Computer Programming II	3	C	-	30	45
CSC 204	Fundamentals of Data Structure	3	R	-	30	45
CSC 206	Foundation of Sequential Program	3	R	-	45	
CSC 208	Discrete Structure	3	R	-	45	-
CSC 210	Computer Hardware	3	R	CSC 101	30	45
MTH 204	Linear Algebra II	2	E	-	30	-
PHY 202	Electric Circuit and Electronics	3	R	-	30	45
ENT 202	Entrepreneurship II	2	C	-	15	45
GST 204	Peace Studies, Conflict Resolution and Ethics	3	C	-	45	-
SIE 299	SIWES I	3	C			
	TOTAL UNITS	**28**				

THIRD YEAR COURSES

Course Code	Course Title 300 Level First Semester	Units	Status	PREQ	LH	PH
CSC 301	Structured Programming	3	C	CSC 201	45	-
CSC 303	Database Management I	3	C	-	45	-
CSC 305	Operating Systems II	3	C	CSC 205	45	-
CSC 307	Systems Analysis and Design	3	R	-	30	45
CSC 309	Computer Architecture and organization I	3	R	-	45	-
CSC 311	Compiler Construction I	3	R	-	45	-
CSC 313	Professional Ethics for Computer Scientists	2	R		30	
GST 303	Nigerian People and Culture	2	C	-	30	
	TOTAL UNITS	**22**				

Course Code	Course Title 300 Level Second Semester	Units	Status	PREQ	LH	PH
CSC 302	Object-Oriented Programming	3	R	CSC 202	45	-
CSC 304	Survey of Programming Language	4	C	-	45	45
CSC 306	Algorithms and Complexity Analysis	3	R	-	45	-
CSC 308	Formal Methods and Software Development	3	C	-	45	
CSC 310	Computer Architecture and Organization II	3	R	-	45	-
CSC 312	Computational Science and Numerical Methods	3	R	-	45	-
GST 302	Life Skills and Personal Effectiveness	2	C	-	30	
SIE 399	SIWES II	3	C	-		
	TOTAL UNITS	**24**				

FOURTH YEAR COURSES

Course Code	Course Title 400 Level First Semester	Units	Status	PREQ	LH	PH
CSC 401	Organization of programming Languages	3	R	CSC 304	45	-
CSC 403	Database Management II	3	C	CSC 303	30	45
CSC 405	Special Topics in Software Engineering	3	C	-	30	45
CSC 407	Computer Networks/Communications	3	C	-	30	45
CSC 409	Human Computer Interface	2	R	-	30	-
	Additional Electives (2)	6	E			
	TOTAL UNITS	**20**				
	Additional Electives (Minimum 2 Courses)					
CSC 411	Information Technology Law	2	E		30	-
CSC 413	Distributed Computing System	3	E		30	45
CSC 415	Optimization Techniques	3	E		30	45
CSC 417	Computer System Performance Evaluation	3	E		45	-
CSC 419	Advances in Web and Mobile Programming	3	E		30	45
CSC 421	Computer Graphics and Visualisation	3	E		30	45
CSC 423	Queuing Systems Performance Evaluation	3	E		45	-

Course Code	Course Title 400 Level Second Semester	Units	Status	PREQ	LH	PH
CSC 402	Software Engineering	4	C	-	45	45
CSC 404	Artificial Intelligence/ Machine Learning	3	R	-	45	-
CSC 406	Net-Centric Computing	3	R	-	45	-
CSC 499	Project	6	C	-	-	270
	Additional Electives (2)	6	E			
	TOTAL UNITS	**22**				
	Additional Electives (Minimum 2 Courses)					
CSC 412	Project Management	3	E		30	45
CSC 414	Formal Models of Computation	3	E		30	45
CSC 416	Advances in Data Sciences	3	E		30	45
CSC 418	Special Topics in Computer Science	3	E		30	45
CSC 420	Modelling and Simulation	3	E		30	45
CSC 422	Compiler Construction II	3	E		45	-

COURSE DESCRIPTION

100 LEVEL FIRST SEMESTER

CSC 101: Introduction to Computer Science (3 Units, LH 30, PH 45)
Survey of computers and information processing and their roles in society. This course introduces a historical perspective of computing, hardware, software, information systems, and human resources and explores their integration and application in business and other segments of society. Students will be required to complete lab assignments using the PC's operating system, and several commonly used applications, such as word processors, spreadsheets, presentations, graphics and other applications. Internet and on-line resources, browsers and search engines.

CHM 101: General Chemistry I (Physical) (3 Units, LH 45)
Atoms, molecules and chemical reactions (types and properties). Modern electronic theory of atoms: atomic Spectra – the Bohr atom and extension of Bohr theory. Electronic configuration, periodicity and building up of the periodic table. Hybridisation, molecular orbital theory, the LCAO method, homo and heteronuclear diatomic molecule, and shape of simple covalent molecules. Valence forces; Structure of Solids. Chemical equations and stoichiometry (Balancing of equation by electron transfer method, mole concepts and calculations involving titrimetry). Chemical bonding and intermolecular forces (van der Waals, hydrogen bonding, dipole-dipole interaction). Kinetic theory of matter: Properties of gases - ideal and non-ideal behaviour. Elementary Thermochemistry; rates of reaction, equilibrium and thermodynamics. Acids, bases and salts. Redox reactions and introduction to electrochemistry. Radioactivity.

CHM 107: General Practical Chemistry I (1 Unit, PH 45)
Laboratory experiments designed to reflect the topics taught in CHM 101 such as qualitative and quantitative chemical analysis, acid-base titrations. Gravimetric analysis. Calculation, data analysis and presentation. Functional group analysis.

MTH 101: Elementary Mathematics I (3 Units, LH 45)
(Algebra & Trigonometry)
Indices and logarithms, Inequalities and polynomials (including factor and remainder theorems), Theory of equations, Theory of quadratic, cubic and quartic equations, Binomial theorem, Partial fractions, Complex numbers, Circular measure, Trigonometric functions of angles of any magnitude, addition and factor formulae, expansion of sin nØ, cos nØ, tan nØ.

MTH 103 Elementary Mathematics II (3 Units, LH 45)
(Set Theory and Numbers)
Elementary set theory, subsets, union, intersection, complements and Venn diagrams, Real numbers: integers, rational and irrational numbers, Surds, Mathematical induction, Real sequences and series, Complex numbers: algebra of complex numbers, the Argand Diagram, De-Moiré's theorem nth roots of unity

PHY 101: General Physics I (3 Units, LH 45)
(*Mechanics & Properties of Matter*)
Space and Time, Units and dimension, Kinematics; Fundamental Laws of Mechanics, statics and dynamics; work and energy; Conservation laws. Moments and energy of rotation; simple harmonic motion; motion of simple systems. Elasticity; Hooke´s law, Young´s shear and bulk moduli. Hydrostatics; Pressure; buoyance, Archimedes' principle; Surface tension: adhesion, cohesion, capillarity, drops and bubbles; Temperature; heat; gas laws; laws of thermodynamics; kinetic theory of gases; Sound: Types and properties of Waves as applied to sound and light energies; Superposition of waves. Propagation of sound in gases, solids and liquids and their properties.

PHY 107: General Practical Physics I (1 Unit, PH 45)
This introductory practical part of course emphasizes quantitative measurements, the treatment of measurement errors, and graphical analysis. A variety of experimental techniques will be employed. The experiments include studies of meters, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, heat, viscosity, etc., covered in PHY 101 and PHY 102. However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis and deduction. A selection of experiments such as: use of measuring instruments, viscosity, surface tension oscillations about an equilibrium position, Hooke's law, moment of inertia, focal lengths of lenses, refractive index, volume expansion and latent heat, etc.

GST 101: Communication in English I (2 Units: LH 30)
Effective communication and writing in English Language skills, essay writing skills (organization and logical presentation of ideas, grammar and style), comprehension, sentence construction, outlines and paragraphs. This course is an overview of grammatical structure. Attention will be paid to the parts of speech (nouns, pronouns, verbs, prepositions, adjectives, adverbs, conjunctions, and interjections) as well as markers of noun (articles, quantifiers predetermines, demonstratives) and modality in verb use. The course will also study phrases and clauses, sentence structure, the sentence in use, punctuation, capitalization and spelling. It will provide an introduction to paragraph structure, critical thinking in writing, speech planning and organization.

GST 103: Use of Library, Study Skills and ICT (2 Units: LH 30)
Brief history of libraries; Library and education; University libraries and other types of libraries; Study skills (reference services); reading and comprehension; listening and comprehension; note-taking and note-making; word processing. The use of dictionaries, encyclopaedia and other reference materials; the library and learning; organization of the library system; finding information in a library; Types of library materials, using library resources including e-learning, e-materials, etc.; Understanding library catalogues (card, OPAC, etc.) and classification; Copyright and its implications; Database resources; Bibliographic citations and referencing. Development of modern ICT; Hardware technology; Software technology; Input devices; Storage devices; Output devices; Communication and internet services; Identification of PC parts and peripheral devices: functions, applications, and how to use them. Safety precautions. Procedure for booting a PC. Filing system: directory, sub-directory, file, path, and how to locate them. Word processing skills (typing, etc.), Spreadsheet, Database management, Presentation software. Exercises.

GST 108: Introduction to Quantitative Reasoning (*Statistics*) (2 Units, LH 30)
Thinking Critically: Propositions and Truth Tables; Approaches to Problem Solving: Working with Units; Numbers in the Real World – Putting Numbers in Perspective; Managing Money: -Taking control of your finances; Putting Statistics to Work; Probability; Exponential Growth; Modelling Our World: The Building Blocks of Mathematical Models.

100 LEVEL SECOND SEMESTER

CSC 102: Introduction to Problem Solving (3 Units: LH 30, PH 45)
Role of Algorithms in problem solving process, concepts and properties of Algorithms. Implementation strategies, Development of Flow Charts, Pseudo Codes. Program objects. Implementation of Algorithms in a programming Language - Python/JAVA/C/C++. (Use Python for Illustrations)

PHY 102: General Physics II (3 units, LH 45)
(Electricity, Magnetism and Modern Physics)
Electrostatics; conductors and currents; dielectrics; magnetic fields and electromagnetic induction, Maxwell's equations; electromagnetic oscillations and waves; Coulomb's laws; method of charging; Ohm's law and analysis of DC circuits; AC Voltages applied to Inductors, Capacitors and resistances; Applications.

PHY 108: General Practical Physics II (1 unit, PH 45)
This is a continuation of the experiments designed for PHY 101 and PHY 102 some of which have been covered under PHY 107.

MTH 102: Elementary Mathematics III (3 units, LH 45)
(*Differential and Integral Calculus)*
Functions of a real variable, graphs, limits and idea of continuity. The derivative as limit of rate of change. Techniques of differentiation, maxima and minima. Extreme curve sketching, integration, Definite integrals, reduction formulae, application to areas, volumes (including approximate integration: Trapezium and Simpson´s rule.

GST 102: Introduction to Christian Theology (3 Units, LH 45)
The Existence of God; Revelation; Supernatural Faith; God's Nature and Action; The Holy Trinity; Creation; Elevation to the Supernatural Order and original Sin; Jesus Christ, True God and True Man; The Incarnation ; The Passion and Death on the Cross; Resurrection, Ascension and Second Coming; The Holy Spirit, the Holy Catholic Church; The Communion of Saints and the Forgiveness of Sin; History of the Church; The Church and the State; The Resurrection of the Body and Life Everlasting; Introduction to the Liturgy and the Sacraments; Baptism and Confirmation; The Eucharist; Penance; Anointing of the Sick; Holy Orders; Marriage; Freedom, Law and Conscience; Morality of Human Acts; Grace and the Virtues; The Person and Society; Personal Sin; The Ten Commandments; Prayer.

GST 104: Logic, Philosophy and Human Existence (2 Units: LH 30)

A brief survey of the main branches of Philosophy; Rudiments and dynamics of critical thinking as a major component of knowledge production. Such forms of knowledge as good and bad arguments, the capacity to think clearly and rationally, to engage in reflective and independent thinking and to reason logically, coherently and purposefully towards a particular end. Topics include: logic and logical reasoning: the nature of reasoning: deduction and induction; the structure of argumentation; forms of fallacies; types of discourse; techniques for evaluating arguments; symbolic logic; Special symbols in Symbolic logic-conjunction, negation, affirmation, disjunction, equivalent and conditional statements, law of tort. The method of deduction using rules of interference and bi-conditional, qualification theory. Types of discourse, nature or arguments, validity and soundness, techniques for evaluating arguments, distinction between inductive and deductive inferences; etc. (Illustrations will be taken from familiar texts, including literature materials, novels, law reports and newspaper publications.

GST 105: Communication in English II (2 Units: LH 30)

Communication in English II builds on the foundation laid by the first part of the course. It aims to strengthen the foundation and further understanding of the grammatical elements through increased writing and reading exercises. The course reviews the use of the parts of speech in writing as well as sentence construction, but it focuses in particular on difficult verbs, the gerund, voice, mood, agreement, high frequency spelling, punctuation, and the rules governing the use of capital letters. It will also provide guidelines on critical reading, summary writing, and speech writing while reviewing argument and paragraph structures.

GST 125: Contemporary Health Issues (2 Units: LH 30)

Diet, exercise and health, nutritional deficiency diseases, malaria, other infections, hypertension, organ failure, air-borne diseases, sexually transmitted diseases, cancer and its prevention, sickle cell disease. HIV/AIDS & COVID-19: Introduction, epidemiology, natural history of infection, transmission of predisposing factors, Impact on the society, management of infection, prevention. Drugs and Society: sources of drugs, classification of drugs, dosage forms and routes of drug administration, adverse drug reactions, drug abuse and misuse, rational drug use and irrational drug use. Human kinetics and health education: personal care and appearance, exercise and health, personality and relationship, health emotions, stress, mood modifiers, refusal to tobacco, alcohol and other psychoactive drugs.

200 LEVEL FIRST SEMESTER

CSC 201: Computer Programming I (3 Units: LH 30, PH 45)

Introduction to problem solving methods and algorithm development, designing, coding, debugging and documenting programmes using techniques of a good programming language style, programming language and programming algorithm development. At least one widely used programming language should be used in teaching. (Use C and JavaScript for illustration – one compiled and the other interpreted).

CSC 205: Operating System I (3 Units: LH 30, PH 45)
Overview of O/S: Role & Purpose, Functionality Mechanisms to Support Client- server models, hand-held devices, Design Issues influences of Security, networking, multimedia, Windows. O/S Principles: Structuring methods, Abstraction, processes of resources, Concept of APIS Device organization interrupts.

MTH 201: Mathematical Methods (3 Units: LH 45)
Sequences of real numbers, Monotone sequence, Convergence, Absolute and conditional convergence, Infinite series, Convergence tests, Addition and multiplication of series. Power series, Radius of convergence, Taylor and Maclaurin series and their applications, Taylor polynomials and Taylor's formula, The binomial theorem and binomial series. Matrices and linear transformations, Matrix operations, Solutions of linear systems by matrices, Rank and inverse, eigenvalues and eigenvectors, canonical forms, Jordan form, generalized inverse of a matrix. Complex numbers and their properties, complex numbers as vectors, the complex plane, Complex algebra, Functions of a complex variable.

STA 205: Statistics for Physical Science and Engineering (3 Units: LH 45)
This course is aimed at presenting examples of application of time series analysis and control in various fields such as engineering, earth science, medical science, biology, and economics.

ENT 201: Entrepreneurship I (2 Units: LH 15, PH 45)
The course lays the groundwork for understanding how to be innovative and entrepreneurial. It is centred on the topics of creativity, learning and purposeful effort. It encompasses a general overview of the principles, theories and practices of innovation and entrepreneurship, the innovation process, and characteristics of entrepreneurs. It will provide students with the knowledge and understanding of how to manage innovation. The course will also explore planning as it relates to owning and operating a business, marketing concepts, licensing, financing, accounting, record keeping systems, and the legal aspects of owning and operating a business.

GST 202: Philosophical Anthropology (2 Units: LH 30)
An introduction to the philosophical basis of considerations about the human person. The course seeks to establish what the human person is. With the aim of bringing the students to a due appreciation of the human reality, a study will be made of the human potencies and faculties, such as the understanding, the imagination, and the will. Particular attention will be paid to human rationality and freedom, qualities which, among others, set the human person apart from other material beings. Fundamental questions about the relations between human nature, religion and culture, as well as the basis of the dignity of the human person will also be dealt with. A study will also be made of various conceptions of the person which are based on ideology.

GST 211: Environment and Sustainable Development (2 Units: LH 30)
Man- his origin and nature; Man and his cosmic environment; scientific methodology, Science and Technology in the society and service of man. Renewable and non-renewable resources –man and his energy resources. Environmental effects of chemical plastic, textiles, Wastes and other materials. Chemical and radiochemical hazards.

Introduction to the various areas of science and technology. Elements of environmental studies.

Electives

MTH 203: Linear Algebra I (3 Units: LH 45)
Vector space over real field. Subspaces, linear independence, basis and dimension. Linear transformations and their representation by matrices-range, null space, rank. Singular and non-singular transformation and matrices. Algebra of matrices.

PHY 201: General Physics III (Modern Physics) (3 Units: LH 45)
The study of Modern Physics is the study of the enormous revolution in the view of physical universe. Topics covered includes: Galilean transformations, The Quantum Theory of Light, Special Relativity, and Relativity: Mass, Energy and Momentum.

200 LEVEL SECOND SEMESTER

CSC 202: Computer Programming II (3 Units: LH 30, PH 45)
Principles of good programming, structured programming concepts, Debugging and testing, string processing, internal searching and sorting, recursion. Use a programming language different from that in CSC 201. (Orient towards solving problems in real-world domains - use Web/Mobile/Desktop programming for illustrations)

CSC 204: Fundamentals of Data Structures (3 Units: LH 30, PH 45)
Primitive types, Arrays, Records Strings and String processing, Data representation in memory, Stack and Heap allocation, Queues, TREES. Implementation Strategies for stack, queues, trees. Run time Storage management; Pointers and References, linked structures.

CSC 206: Foundations of Sequential Program: (3 Units: LH 45)
The relationships between H/L languages and the Computer Architecture that underlies their implementation: basic machine architecture, specification and translation of P/L Block Structured Languages, parameter passing mechanisms.

CSC 208: Discrete Structure (3 Units: LH 45)
Basic Set Theory: Basic definitions, Relations, Equivalence Relations Partition, Ordered Sets. Boolean Algebra & Lattices, Logic, Graph theory: Directed and Undirected graphs, Graph Isomorphism, Basic Graph Theorems, Matrices; Integer and Real matrices, Boolean Matrices, Matrices med m, Path matrices. Adjacency Vectors/Matrices: Path adjacency matrix, Numerical & Boolean Adjacency matrices. Applications to counting, Discrete Probability Generating Functions,

CSC 210: Computer Hardware: (3 Units: LH 30, PH 45)
Computer circuits; diode arrays, PIAs etc., Integrated circuits fabrication process. Use of MSI, LSI and VLSI IC' hardware Design. Primary and Secondary memories; core memory, etc. Magnetic devices; disks, tapes, video disks etc. Peripheral devices; printers, CRT's,

keyboards, character recognition. Operational amplifiers; analog-to- digital and digital-to-analog converter.

PHY 202: Electric Circuit and Electronics (3 Units: LH 30, PH 45)

Circuit elements, sources, circuit theorems, applications. Network response to steps, ramp, impulse, Network functions, response to exponential, sinusoidal sources. Laplace transform, pole- zero analysis, network synthesis, resonance, two-point analysis, ladder network, Star- Delta transformation.

ENT 202: Entrepreneurship II (2 Units: LH 15, PH 45)

The work in this course is fully practical. Each group, made up of between six and ten students will be given as seed capital the naira equivalent of $250. Each group will register their business, open a bank account, mobilise additional funds and run the business throughout the semester. At the end of the semester, the business will be officially liquidated, the seed capital returned to EDC and the profit donated to a charity of their choice or used to improve the community around the University. At the very least, each group MUST break even and return the seed capital. A report will be submitted by each group focusing on how they have been able to use entrepreneurial principles learnt in ENT 201 and, more importantly, what they have learnt during their entrepreneurial journey.

GST 204: Peace Studies, Conflict Resolution and Ethics (3 Units: LH 45)

Basic concepts in peace studies and conflict resolution. Peace as a vehicle of unity and development. Conflict issues. Types of conflict. Root causes of conflicts and violence in Africa. Peace building. Developing a culture of peace. Peace mediation and peace-keeping. Role of international organizations in conflict resolution. (ECOWAS, AU, UN etc.) Human fulfilment and its main dimensions. Analysis of human actions. Ethical principles. Moral Absolutes. Virtue ethics, natural law. Consideration of some specific ethical issues: euthanasia, abortion, environmental ethics. Pacifism versus the just war tradition.

SIE 299: Industrial Training I (3 Units)

Require 3 months of Industrial Training. Students' experience will be documented and presented in a Seminar.

Elective

MTH 204: Linear Algebra II (2 Units: LH 30)

Systems of linear equation change of basis, equivalence and similarity. Eigenvalues and eigenvectors. Minimum and characteristic polynomials of a linear transformation (Matrix). Caley-Hamilton theorem. Bilinear and quadratic forms, orthogonal diagonalisation. Canonical forms.

300 LEVEL FIRST SEMESTER

CSC 301: Structured Programming (3 Units: LH 45)
Structured Programming elements, structured design principles, abstraction modularity, stepwise refinement, structured design techniques. Teaching of a structured programming language etc. (Use C/C++ for illustrations)

CSC 303: Data Management I (3 Units: LH 45)
Information storage & retrieval, Information management applications, Information capture and representation, analysis & indexing, search, retrieval, information privacy; integrity, security; scalability, efficiency and effectiveness. Introduction to database systems: Components of database systems DBMS functions, Database architecture and data independence use of database query language.

CSC 305: Operating System II (3 Units: LH 45)
Concurrency: States & State diagrams Structures, Dispatching and Context Switching; interrupts; Concurrent execution; Mutual exclusion problem and some solutions Deadlock; Models and mechanisms (Semaphores, monitors etc.) Producer – Consumer Problems & Synchronization. Multiprocessor issues. Scheduling & Despatching Memory Management: Overlays, Swapping and Partitions, Paging & Segmentations Placement & replacement policies, working sets and Trashing, Caching.

CSC 307: Systems Analysis and Design (3 Units: LH 30; PH 45)
System Concept; System Development Life Cycle Analysis: Fact gathering Techniques, data flow diagrams, Process description data modelling. System Design: Structure Charts, form designs, security, automated Tools for design.

CSC 309: Computer Architecture and Organization I (3 Units: LH 45)
Fundamental building blocks, logic expressive immunization, sum of product forms. Register transfer notation, Physical considerations. Data representation, and number bases, Fixed and Floating point systems, representation memory systems organization and architecture.

CSC 311: Compiler Construction I (3 Units: LH 45)
Review of compilers assemblers and interpreters, structure and functional aspects of a typical compiler, syntax semantics and, functional relationship between lexical analysis, expression analysis and code generation. Internal form of course programme. Use of a standard compiler as a working vehicles. Error detection and recovery. Grammars and Languages: the parsing problem. The scanner.

GST 303: Nigerian Peoples and Culture (2 Units, LH 30)
Study of Nigerian history, culture and arts in pre-colonial times. Cultural areas and their characteristics. Evolution of Nigeria as a political unit. Culture is a way of life and persons are defined by the cultures within which they live. An understanding of persons thus requires a knowledge of their culture. The course studies the ways of life of people in Nigeria. It examines the customs, traditions, beliefs, and values of various groups. While particular emphasis shall be placed on the various cultures found within Nigeria, a survey of the history and culture of people of the great empires of ancient and pre-

colonial Africa will be made together with a study of Africa today and the African image in the contemporary world.

CSC 313: Professional Ethics for Computer Scientists (2 Units, LH 30)

Computer scientists create systems and tools that are used as mission critical applications and more. Besides, through their created programs, computer scientists can be exposed to sensitive data about organizations or persons. These responsibilities and positioning naturally call for ethical considerations. It is thus important for a computer scientist to have a good understanding of the principles of ethics and in particular, its applicability to data privacy issues.

In this course, students will learn about business and professional ethics especially as they relate to data handling, systems design and manipulation.

300 LEVEL SECOND SEMESTER

CSC 302: Object-Oriented Programming (3 Units: LH 45)

Basic OOP Concepts: Classes, Objects, inheritance, polymorphism, Data Abstraction, Tools for developing, Compiling, interpreting and debugging, Java Programs, Java Syntax and data objects, operators. Central flow constructs, objects and classes programming, Arrays, methods. Exceptions, Applets and the Abstract, OLE, Persistence, Window Toolkit, Laboratory exercises in an OOP Language. (Use Java, C++ and C# for illustrations)

CSC 304: Survey of Programming Languages (4 Units: LH 45; PH 45)

Overview of programming languages: History of programming languages, Brief survey of programming paradigms (Procedural languages, Object-oriented languages, Functional languages, Declarative – non-algorithmic languages, Scripting languages), the effects of scale on programming methodology; Language Description: Syntactic Structure (Expression notations, abstract Syntax Tree, Lexical Syntax, Grammars for Expressions, Variants of Grammars), Language Semantics (Informal semantics, Overview of formal semantics, Denotation semantics, Axiomatic semantics, Operational semantics); Declarations and types: The concept of types, Declaration models (binding, visibility, scope, and lifetime), Overview of type-checking, Garbage collection; Abstraction mechanisms: Procedures, function, and iterations as abstraction mechanisms, Parameterization mechanisms (reference vs. value), Activation records and storage management, Type parameters and parameterized types, Modules in programming languages; Object oriented language paradigm; Functional and logic language paradigms.

CSC 306: Algorithms and Complexity Analysis (3 Units: LH 45)

Basic algorithmic analysis: Asymptotic analysis of Upper and average complexity bounds; standard Complexity Classes Time and space trade-offs in algorithms analysis recursive algorithms. Algorithmic Strategies: Fundamental computing algorithms: Numerical algorithms, sequential and binary search algorithms; sorting algorithms, Binary Search tress, Hash tables, graphs & its representation.

CSC 308: Formal Methods and Software Development (3 Units: LH 45)
Formal methods: Mathematical approaches to solving software (and hardware) problems at the requirements, specification, and design levels.

CSC 310: Computer Architecture and Organization II (3 Units: LH 45)
Memory system, general; characteristics of memory operation. (Technology-magnetic recording semi-conductor memory, coupled devices, magnetic bubble). Memory addressing, memory hierarchy, virtual memory control systems. Hardware control, micro programmed control, Asynchronous control, I/C control. Introduction to the methodology of faulty tolerant computing.

CSC 312: Computational Science and Numerical Methods (3 Units: LH 45)
Operations research, Numerical Computation, Graphical computation, Modelling and simulation, High performance computation.

GST 302: Life Skills and Personal Effectiveness (2 Units, LH 30) This course provides practical strategies for improving self-management skills in order to develop one's effectiveness. It will dwell on how to manage difficult situations, maintain a sense of purpose and direction under pressure and develop the confidence to manage a wide range of situations and people. Through this course, the students will learn to make the most of all the personal resources at their disposal. They will be taught to harness their personal talents, energy and time, relative to what is most important, and then to channel the outcomes to achieve what is desirable. It focuses on such practical matters as personal development; inter-personal communication; etiquette and good manners; health and hygiene; money management; work and career.

SIE 399: Industrial Training II (3 Units)
Student's Industrial work experience of 3 months' duration. Students' reports will be presented in a seminar.

400 LEVEL FIRST SEMESTER

CSC 401: Organization of Programming Languages (3 Units: LH 45)
Language definition structure. Data types and structures, Review of basic data types, including lists and tress, control structure and data flow, Run-time consideration, interpretative languages, 20lexical analysis and parsing. Pre-requisite – CSC 201, 202, 304, 302.

CSC 403: Data Management II (3 Units: L H 30; P 45)
Rational Databases: Mapping conceptual schema to relational Schema; Database Query Languages (SQL) Concept of Functional dependencies & Multi-Valued dependencies. Transaction processing; Distributed databases. Text: CJ Date.

CSC 405: Special Topics in Software Engineering (3 Units: LH 30; PH 45)
Topics from process improvement ; software re-engineering configuration management; Formal specification, software cost – estimation, Software architecture, Software patterns, Software Re-use and Open source development.

CSC 407: Computer Networks/Communication (3 Units: LH 30; PH 45)
Introduction, wares, Fourier analysis, measure of communication, channel characteristics, transmission media, noise and distortion, modulation and demodulation, multiplexing, TDM FDM and FCM Parallel and serial transmission (synchronous vs asynchronous). Bus structures and loop systems, computer network Examples and design consideration, data switching principles broadcast techniques, network structure for packet switching, protocols, description of net-work e.g. ARPANET, etc.

CSC 409: Human-Computer Interface (HCI) (2 Units: LH 30)
Foundations of HCI, Principles of GUI, GUI toolkits; Human-centred software evaluation and development; GUI design and programming.

Electives

CSC 413: Distributed Computing Systems (3 Units: LH 30; P 45)
Introduction: Definitions, Motivation; Communication Mechanisms: Communication Protocols, RPC, RMI, Stream Oriented Communication; Synchronization: Global State, Election, Distributed Mutual Exclusion, Distributed Transactions; Naming: Generic Schemes, DNS, Naming and Localization; Replication and Coherence: Consistency Models And Protocols; Fault Tolerance: Group Communication, Two-And Three-Phase Commit, Check pointing; Security: Access Control, Key Management, Cryptography; Distributed File Systems: NFS, Coda etc.

CSC 417: Computer System Performance Evaluation (3 Units: LH 45)
Measurement techniques, simulation techniques; techniques, workload characterization, performance evaluation in selection problems, performance evaluation in design problems, evaluation of programme performance.

CSC 421: Computer Graphics and Visualization (3 Units: LH 30; P 45)
Hardware aspect, plotters microfilm, plotters display, graphic tablets, light pens, other graphical input aids Facsimile and its problems Refresh display refresh huggers, changing images, light pen interaction. Two and three dimensional transformation, perspective clipping algorithms. Hidden line removal bolded surface removal. Warnock method/ algorithm, shading, data reduction for graphical input. Introduction to hand writing and character recognition. Curve synthesis and fitting. Contouring. Ring structures versus doubly linked lists. Hierarchical structures. Data structure: Organization for interceptive graphics.

CSC 423: Queuing Systems: (3 Units: LH 45)
Introduction; Birth-death queuing systems; Markovian queues, the queue M/GI bounds, inequalities and approximations.

400 LEVEL SECOND SEMESTER

CSC 402: Software Engineering (4 Units: LH 45; PH 45)
Software Design: Software architecture, Design Patterns, O. O. analysis & Design, Design for re-use. Using APIS: API programming Class browsers and related tools, Component

based computing. Software tools and Environment: Requirements analysis and design modelling Tools, Testing tools, Tool integration mech.

CSC 404: Artificial Intelligence/Machine learning (3 Units: LH 45)
Introduction to artificial intelligence, understanding natural languages, knowledge representation, expert systems, pattern recognition, the language LISP. The students will also be exposed to both supervised and non-supervised machine learning algorithms, with practical examples and hands-on activities.

CSC 406: Net-Centric Computing (3 Units: LH 45)
Distributed Computing, Mobile & Wireless computing, Network Security; Client/Server Computing (using the web), Building Web Applications.

CSC 499: Project (6 Units: PH 270)
Students should embark on work that will lead to substantial software development under the supervision of a member of staff. CSC 493: Advances in Web and Mobile programming highly scalable Web applications backend, Progressive Web, WebGL, WebXR, etc. Native mobile applications development. Building Web and mobile applications frameworks, API development, and other advances in Web and Mobile applications development. CSC 494: Advances in Data sciences/ML Intermediate to advanced concepts in Data Sciences and Machine Learning. Data science application in various fields.

Electives

CSC 412: Project Management (3 Units: LH 30; PH 45)
Team Management, Project Scheduling, Software measurement and estimation techniques, Risk analysis, Software quality assurance, Software Configuration Management, Project Management tools.

CSC 414: Formal Models of Computation (3 Units: LH 30; PH 45)
Automata theory: Roles of models in computation. Finite state Automata, Push-down Automata, Formal Grammars, Parsing, Relative powers of formal models. Basic computability: Turing machines, Universal Turing Machines, Church's thesis, solvability and Decidability.

CSC 416: Advances in Data Science (3 Units: LH 30; PH 45)

This course begins with an overview of the field, covering the vocabulary, skills, jobs, tools, and techniques of data science and analytics.

Students will learn to identify the relationship between data science and other data-driven fields such as machine learning and artificial intelligence.

With practical examples, they will review the primary practices: gathering and analyzing data, formulating rules for classification and decision-making, and drawing actionable insights.

By the end, students would have learnt how data science can help them make better decisions, gain deeper insights, and make their work more effective and efficient.

CSC 418: Special Topics in Computer Science (3 Units: LH 30; PH 45)

Special topics from any area of computer science considered relevant at given time. Topics are expected to change from year to year. Apart from seminars to be given by lecturers and guests, students are expected to do substantial readings on their own.

CSC 422: Compiler Construction II (3 units: LH 45)

Grammars and languages, recognizers, Top-down and bottom-up language Run-time storage Organization, The use of display in run-time storage Organization. The use of display in run time storage allocation. LR grammars and analysers. Construction of LR table. Organisation of symbol tablets. Allocation of storage to run-time variables. Code generation. Optimisation/Translator with systems.

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