SULE LAMIDO UNIVERSITY, KAFIN HAUSA
Faculty of Computing and Information Technology (FCIT)

B.Sc Information Technology

The Core Curriculum and Minimum Academic Standard for the Nigerian University System

Mission and vision Statement of the University:

Mission: To produce graduates, sound in character and learning, at undergraduate and graduate levels, imbued with the spirit of service and dedication to innovative application of knowledge aimed at improving the lives of people within Jigawa State, the nation and humanity in general.

Vision: To be a top class University that provides a stimulating teaching, learning and research environment in pursuit of solution to societal problems.

University Motto: Knowledge for Service

Principal Officers of the University

Vice Chancellor
Prof. Muhammad Ibrahim Yakasai

Registrar
Mal. Adamu Mohammed

Bursar
Mal.

University Librarian
Dr. Abdulkadir Idris

STAFF LIST

S/N	NAMES	QUALIFICATION	AREA OF SPECIALIZATION	DESIGNATION
1	Prof. Nasir Faruk	**Ph.D**	Professor of Telecommunications	**Dean**
2	Dr. Babangida Isyaku	**Ph.D**	Emerging Networks	**HOD**
3	Ismail Ibrahim	**M.IT**	Info Tech	**AL**
4	Shafi'u Sani	**B.Tech**	Info Tech	**GA**
5	Mukhtar Abdulganiyu	**B.Sc.**		**GA**
6	Musa Abubakar	**B.Sc.**		**GA**

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2. Mal. Abdullahi Muhammad (Secretary)
3. Dr. Abdullahi Haruna Birniwa (Director of Acad. Planning)
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10. Dr. Muhammad Abdulkadir (Director SPS)
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B.Sc. Information Technology

Overview

Information Technology (IT) is a rapidly growing field that today, organisations of every kind are dependent on IT. This underscores the need to have appropriate systems in place that work properly and are secured.

The B.Sc. Information Technology programme is geared towards producing graduates who possess the right combination of knowledge and practical hands-on expertise to take care of both the organisation's Information Technology infrastructure and the end user. IT specialists assume responsibility for selecting hardware and software products appropriate for an organisation, and integrating these products with organisational needs and infrastructure as well as installing, customising, and maintaining these applications.

Philosophy

The philosophy of the programme is to produce Information Technology graduates who are well grounded in theory and practice on the analysis, design, implementation and management of Information Technology solutions and resources, and also recognise the impact of this technology on individuals, organisations and society at large.

Objectives

The objectives of the Bachelor of Science in Information Technology Programme are to:

i. provide students with a broad and balanced foundation of Information Technology knowledge and practical skills;
ii. equip students with the necessary professional skills to practice as successful IT professionals and compete effectively in a world of rapid technological change;
iii. develop in students a range of transferable skills of Information Technology in all aspects of human endeavour;
iv. develop students for the purpose of self-employment and job placement in the government and industries serving the needs of the local and global community; and
v. Develop skills for career development and life-long learning.

Unique Features of the Programme

The curriculum features an inclusive emphasis on hands-on laboratory practical and relevant skills in the areas of web technologies, network servers and infrastructures, mobile and pervasive computing, and mobile and web application development. The acquired skills among others will equip the students to face the dynamics of computing in the 21st century.

Employability Skills

The dynamic nature of computing coupled with the advances in Information Technology has necessitated the need for Information Technology graduates to have all the necessary employability skills required in today' s competitive world. The skills include communication, teamwork and collaboration, negotiation and persuasion, problem-solving, leadership, organisation, perseverance, motivation, confidence, and the ability to work under pressure.

21st Century Skills

Cybersecurity students will be required to have the following 21st century skills:

i. creativity;
ii. information literacy;creativity;
iii. flexibility;
iv. social skills;
v. problem solving;

vi. innovation skills; and
vii. critical thinking.

Admission and Graduation Requirements

Admission requirements
4 Year Degree Programme
In addition to appropriate UTME-Score, a candidate must possess five Senior Secondary Certificate (SSC)-credits passes including English Language, Mathematics, Physics and any other relevant Science subjects in not more than two sittings.

3 Year Degree Programme:
Direct Entry
A minimum of a credit at the University/National Diploma or NCE with other five Senior Secondary Certificate (SSC) credit passes in relevant Science subjects three of which must be in English Language, Mathematics, Physics.

Minimum duration
The minimum duration of the Information Technology degree programme is four academic sessions for UTME students, however, it is three academic sessions for candidates admitted to the 200 Level.

Graduation requirements:
To be eligible for the award of the Bachelor degree in Cybersecurity, a student must have:

1. Passed all the core courses, university and faculty/school required courses and electives.
2. Accumulated a minimum of 120 course units for students admitted through UTME and 90 course units for students admitted to 200 level.
3. Attain a minimum CGPA of 1.00.

To graduate, a student must be found worthy in character throughout the period of his/her studentship and must accumulate the total units prescribed for the programme from Core, Faculty and General Studies courses as well as SIWES, Seminar and Final Year Project.

Summary of Graduation Requirement for B.Sc. Computer Science

LEVEL	CCMAS 70%				Additional 30%			Required units	
	Specialization	Faculty	General	Total	Core	Elect.	Total	Min	Max
100	-	5	17	22	8	-	8	30	30
200	11	8	4	23	7	2	8	30	32
300	15	6	4	25	6	-	6	31	31
400	12	4	-	16	14	-	14	30	30
Total	38	23	25	86	39	2	39	121 DE (91)	123 DE (93)

Global Course Structure:

LEVEL 100

First Semester

Course Code	Course Title	Credit Units	Course Status	LH	PH
GST 111	Communication in English	2	C	30	0
COS 101	Introduction to Computer Science	3	C	30	45
MTH 101	Elementary Mathematics I	2	C	30	0
STA 111	Descriptive Statistics	3	C	45	0
PHY 101	General Physics I	2	C	30	0
PHY 107	General Practical Physics I	1	C	0	45
SLU-COS 121	Introduction to Application Packages	2	C	15	45
	Total	**15 Units**			

Second Semester

Course Code	Course Title	Credit Units	Course Status	LH	PH
GST 112	Nigeria People and Culture	2	C	30	0
COS 102	Introduction to Problem Solving	2	C	15	45
MTH 102	Elementary Mathematics II	2	C	30	0
PHY 102	General Physics II	2	C	30	0
PHY 108	General Practical Physics II	1	C	0	45
SLU-IFT 132	Introduction to information System	3	C	30	45
SLU-STA 122	Probability I	2	C	30	0
	Total	**15 Units**			

Summary: Level 100 Student should register a total of **30 credit unit** for this session; **15 credit** for first semester and **15 credit** for second semester.

LEVEL 200

First Semester

Course Code	Course Title	Credit Units	Course Status	LH	PH
COS 201	Computer Programming I	3	C	30	45
IFT 205	Introduction to Information Technology	2	C	30	0
IFT 203	Introduction to Web Technologies	2	C	15	45
IFT 211	Digital Logic Design	2	C	30	0
ENT 211	Entrepreneurship and Innovation	2	C	30	0
SLU-IFT 207	Information Technology in Business	2	C	30	0
SLU-SEN 201	Introduction to Software Engineering	2	C	30	0
	Total	**15 Units**			

Second Semester

Course Code	Course Title	Credit Units	Course Status	LH	PH
IFT 212	Computer Architecture and Organisation	2	C	15	45
COS 202	Computer Programming II	3	C	30	45
INS 202	Human-Computer Interface	2	C	30	0
GST 212	Philosophy, Logic and Human Existence	2	C	30	0
IFT 299	SIWES I	3	C	0	135
SLU-IFT 214	Fundamentals of Networking	3	C	30	45
SLU-IFT 216	IT Governance and Resource Management	2	E	30	0
	Total	**17 Units**			

Summary: Level 200 Student should register a total of **30 credit unit** core for this session; **15 credit** for first semester and **15 credit** for second semester.
Level 200 Student may choose an elective of 2 credit unit in the second semester.

LEVEL 300
First Semester

Course Code	Course Title	Credit Units	Course Status	LH	PH
IFT 302	Web Application Development	2	C	15	45
IFT 322	IT Innovation and Entrepreneurship	2	C	15	45
IFT 310	Mobile Application Development	2	C	15	45
IFT 308	Ethics and Legal Issues in IT	2	C	15	45
ICT 305	Data Communications Systems and Network	3	C	30	45
SLU-IFT 337	LAN, Switching & Internetworking	2	C	15	45
SLU-COS 309	Artificial Intelligence	2	C	15	45
	Total	**15 Units**			

Second Semester

Course Code	Course Title	Credit Units	Course Status	LH	PH
IFT 342	Network Servers and Infrastructures	2	C	15	45
CSC308	Operating Systems	3	C	30	45
IFT 304	Web Development using Content Management Systems	2	C	15	45
GST 312	Peace and Conflict Resolution	2	C	30	0
ENT 312	Venture Creation	2	C	15	45
IFT 399	SIWES II	3	C	0	135
SLU-IFT 336	Routing Protocol Concepts	3	C	15	45
	Total	**17 Units**			

Summary: Level 300 Student should register a total of **31 credit unit** for this session; **15 credit unit** for first semester and **16 credit unit** for second semester.

LEVEL 400
First Semester

Course Code	Course Title	Credit Units	Course Status	LH	PH
COS 409	Research Methodology and Technical Report Writing	2	C	30	0
INS 401	Project Management	2	C	30	0
IFT 403	Mobile and Pervasive Computing	2	C	30	0
IFT 422	Wireless Communications and Networking I	2	C	30	0
IFT 497	Final Year Student's Project I	3	C	0	135
SLU-IFT 405	Enterprise Systems	2	C	30	0
SLU-IFT 407	Database Design and Management I	2	C	15	45
	Total	**15 Units**			

Second Semester

Course Code	Course Title	Credit Units	Course Status	LH	PH
IFT 410	System Integration and Architecture	2	C	15	45
IFT 498	Final Year Student's Project II	3	C	0	135
SLU-IFT 402	Integrative Programming and Technologies	2	C	30	45
SLU-IFT 404	Applied Networks and Security	3	C	30	45
SLU-IFT 406	Wireless Communications and Networking II	3	C	30	45
SLU-IFT 408	Information Assurance and Security	2	C	30	0
	Total	**15 Units**			

Summary: Level 400 Student should register a total of **30 credit unit** for this session; **15 credit** for first semester and **15 credit** for second semester.

Summary of TCU

S/No.	Level	UTME	DE
1.	100	30	-
2.	200	30	30
3.	300	31	31
4.	400	30	30
Total		**121**	**91**

LEARNING OBJECTIVES AND COURSE CONTENT

LEVEL 100 Courses

GST 111: Communication in English **(2 Units C: LH 15; PH 45)**

Learning Outcomes At the end of this course, students should be able to:
1. identify possible sound patterns in English Language;
2. list notable Language skills;
3. classify word formation processes;
4. construct simple and fairly complex sentences in English;
5. apply logical and critical reasoning skills for meaningful presentations;
6. demonstrate an appreciable level of the art of public speaking and listening; and
7. write simple and technical reports.

Course Contents

Sound patterns in English Language (vowels and consonants. Phonetics and phonology). English word classes (lexical and grammatical words, definitions, forms, functions, usages, collocations). Sentence in English (types: structural and functional, simple and complex). Grammar and Usage (tense, mood, modality and concord, aspects of language use in everyday life). Logical and Critical Thinking and Reasoning Methods (Logic and Syllogism, Inductive and Deductive Argument and Reasoning Methods, Analogy, Generalisation and Explanations). Ethical considerations, Copyright Rules and Infringements. Writing Activities: (Pre-writing, Writing, Post-writing, Editing and Proofreading; Brainstorming, outlining, Paragraphing, Types of writing, Summary, Essays, Letter, Curriculum Vitae, Report writing, Note making, etc. Mechanics of writing). Comprehension Strategies: (Reading and types of Reading, Comprehension Skills, 3RsQ). Information and Communication Technology in Modern Language Learning. Language skills for effective communication. Major word formation processes. Writing and reading comprehension strategies. Logical and critical reasoning for meaningful presentations. Art of public speaking and listening. Report writing.

GST 112: Nigerian Peoples and Culture **(2 Units C: LH 30)**

Learning Outcomes At the end of the course, students should be able to:
1. analyse the historical foundation of the Nigerian culture and arts in pre-colonial times;
2. list and identify the major linguistic groups in Nigeria;
3. explain the gradual evolution of Nigeria as a political unit;
4. analyse the concepts of Trade, Economic and Self-reliance status of the Nigerian peoples towards national development;
5. enumerate the challenges of the Nigerian State towards Nation building;
6. analyse the role of the Judiciary in upholding people's fundamental rights;
7. identify acceptable norms and values of the major ethnic groups in Nigeria; and
8. list and suggest possible solutions to identifiable Nigerian environmental, moral and value problems.

Course Contents

Nigerian history, culture and art up to 1800 (Yoruba, Hausa and Igbo peoples and culture; peoples and culture of the ethnic minority groups). Nigeria under colonial rule (advent of colonial rule in Nigeria; Colonial administration of Nigeria). Evolution of Nigeria as a political unit (amalgamation of Nigeria in 1914; formation of political parties in Nigeria; Nationalist movement and struggle for independence). Nigeria and challenges of nation-building (military intervention in Nigerian politics; Nigerian Civil War). Concept of trade and economics of selfreliance (indigenous trade and market system; indigenous apprenticeship system among Nigeria people; trade, skill acquisition and self-reliance). Social justice and national development (law definition and classification). Judiciary and fundamental rights. Individual, norms and values (basic Nigeria norms and values, patterns of citizenship acquisition;

citizenship and civic responsibilities; indigenous languages, usage and development; negative attitudes and conducts. Cultism, kidnapping and other related social vices). Re-orientation, moral and national values (The 3R's – Reconstruction, Rehabilitation and Re-orientation) Reorientation Strategies: Operation Feed the Nation (OFN), Green Revolution, Austerity Measures, War Against Indiscipline (WAI), War Against Indiscipline and Corruption (WAIC), Mass Mobilisation for Self-Reliance, Social Justice and Economic Recovery (MAMSER), National Orientation Agency (NOA). Current socio-political and cultural developments in Nigeria.

COC 101: Introduction to Computer Science (3 Units: LH 30, PH 45)

Learning Outcomes

At the end of the course, students should be able to:

1. explain basic components of computers and other computing devices;
2. describe the various applications of computers;
3. explain information processing and its roles in the society;
4. describe the Internet, its various applications and its impact;
5. explain the different areas of the computing discipline and its specializations; and
6. demonstrate practical skills on using computers and the internet.

Course Contents

Brief history of computing. Description of the basic components of a computer/computing device. Input/Output devices and peripherals. Hardware, software and human ware. Diverse and growing computer/digital applications. Information processing and its roles in society. The Internet, its applications and its impact on the world today. The different areas/programs of the computing discipline. The job specializations for computing professionals. The future of computing.

Lab Work: Practical demonstration of the basic parts of a computer. Illustration of different operating systems of different computing devices including desktops, laptops, tablets, smart boards and smart phones. Demonstration of commonly used applications such as word processors, spreadsheets, presentation software and graphics. Illustration of input and output devices including printers, scanners, projectors and smartboards. Practical demonstration of the Internet and its various applications. Illustration of browsers and search engines. How to access online resources.

COC 102: Introduction to Problem Solving (2 Units C: LH 30; PH 0)

Learning Outcomes:

At the end of this course, students should be able to:

1. explain problem solving processes;
2. demonstrate problem solving skills;
3. describe the concept of algorithms development and properties of algorithms;
4. discuss the solution techniques of solving problem;
5. solve computer problems using algorithms, flowcharts, pseudocode, etc.; and
6. solve problems using programming language using C, PYTHON etc.

Course Contents

Core concepts of computing. Identification of problems. Types of problems (routine problems and non-routine problems). Problem-solving. Methods of solving computing problems. Algorithms and heuristics. Solvable and unsolvable problems. Solution techniques of solving problems; abstraction; analogy; brainstorming; trial and error; hypothesis testing; reduction; literal thinking; means-end analysis. Method of the focal object; morphological analysis; research; root cause analysis; proof; divide and conquer. General Problem-solving process. Solution formulation and design; flowchart; pseudocode; decision table; decision tree. Programming in any language. 210 Lab Work: Use of simple tools for algorithms and flowcharts; writing pseudocode; writing assignment statements, input-output

statements and condition statements; demonstrating simple programs using any programming language (Visual Basic, Python, C)

MTH 101: Elementary Mathematics I (Algebra and Trigonometry) (2 Units C: LH 30)
Learning Outcomes: At the end of the course students should be able to:
1. understand the basic definition of Set, Subset, Union, Intersection, Complements and use of Venn diagrams;
2. solve quadratic equations;
3. solve trigonometric functions;
4. understand various types of numbers; and
5. solve some problems using the Binomial theorem.

Course Contents
Elementary set theory, subsets, union, intersection, complements, venn diagrams. Real numbers; integers, rational and irrational numbers, mathematical induction, real sequences and series, theory of quadratic equations, binomial theorem. Complex numbers; algebra of complex numbers; the Argand diagram. De-Moivre's theorem, nth roots of unity. Circular measure, trigonometric functions of angles of any magnitude, addition and factor formulae.

MTH 102: Elementary Mathematics II (Calculus) (2 Units C: LH 30)
Learning Outcomes At the end of the course, students should be able to:
1. distinguish types of rules in Differentiation and Integration;
2. describe the meaning of Function of a real variable, graphs, limits and continuity; and
3. solve some applications of definite integrals in areas and volumes.

Course Contents
Function of a real variable, graphs, limits and idea of continuity. The derivative, as limit of rate of change. Techniques of differentiation. Extreme curve sketching; Integration as an inverse of differentiation. Methods of integration, Definite integrals. Application to areas, volumes.

STA 111: Descriptive Statistics: (3 Units C: LH 45)
Learning Outcomes:
At the end of the course, students should be able to:
1. explain the basic concepts of descriptive statistics.
2. present data in graphs and charts.
3. differentiate between measures of location, dispersion and partition.
4. describe the basic concepts of Skewness and Kurtosis as well as their utility function in a given data set.
5. differentiate rates from ratio and how they are use.
6. compute the different types of index number from a given data set and interpret the output.

Course content
Statistical data. Types, sources and methods of collection. Presentation of data. Tables chart and graph. Errors and approximations. Frequency and cumulative distributions. Measures of location, partition, dispersion, skewness and Kurtosis. Rates, ratios and index numbers.

SLU-PHY 101 General Physics I (Mechanics) (2 Units C: LH 30)
Learning Outcomes:
At the end of the course students should be able to:
1. identify and deduce the physical quantities and their units;
2. differentiate between vectors and scalars;
3. describe and evaluate motion of systems on the basis of the fundamental laws of mechanics;

4. apply Newton's laws to describe and solve simple problems of motion;
5. evaluate work, energy, velocity, momentum, acceleration, and torque of moving or rotating objects;
6. explain and apply the principles of conservation of energy, linear and angular momentum.
7. describe the laws governing motion under gravity; and
8. explain motion under gravity and quantitatively determine behaviour of objects moving under gravity.

Course Contents
Space and time; units and dimension, Vectors and Scalars, Differentiation of vectors: displacement, velocity and acceleration; kinematics; Newton laws of motion (Inertial frames, Impulse, force and action at a distance, momentum conservation); Relative motion; Application of Newtonian mechanics; Equations of motion; Conservation principles in physics, Conservative forces, conservation of linear momentum, Kinetic energy and work, Potential energy, System of particles, Centre of mass; Rotational motion; Torque, vector product, moment, rotation of coordinate axes and angular momentum. Polar coordinates; conservation of angular momentum; Circular motion; Moments of inertia, gyroscopes and precession; Gravitation: Newton's Law of Gravitation, Kepler's Laws of Planetary Motion, Gravitational Potential Energy, Escape velocity, Satellites motion and orbits.

SLU-PHY 102: General physics II (Electricity & magnetism) (2 Units C: LH 30)
Learning Outcomes:
At the end of the course, students should be able to:
1. describe the electric field and potential, and related concepts, for stationary charges;
2. calculate electrostatic properties of simple charge distributions using Coulomb's law, Gauss's law, and electric potential;
3. describe and determine the magnetic field for steady and moving charges;
4. determine the magnetic properties of simple current distributions using Biot-Savart and Ampere's law;
5. describe electromagnetic induction and related concepts and make calculations using Faraday and Lenz's laws;
6. explain the basic physical of Maxwell's equations in integral form;
7. evaluate DC circuits to determine the electrical parameters;
8. determine the characteristics of ac voltages and currents in resistors, capacitors, and Inductors.

Course Contents
Forces in nature. Electrostatics (electric charge and its properties, methods of charging). Coulomb's law and superposition. Electric field and potential. Gauss's law. Capacitance. Electric dipoles. Energy in electric fields. Conductors and insulators. DC circuits (current, voltage and resistance. Ohm's law. Resistor combinations. Analysis of DC circuits. Magnetic fields. Lorentz force. Biot-Savart and Ampère's laws. Magnetic dipoles. Dielectrics. Energy in magnetic fields. Electromotive force. Electromagnetic induction. Self and mutual inductances. Faraday and Lenz's laws. Step up and step down transformers. Maxwell's equations. Electromagnetic oscillations and waves. AC voltages and currents applied to inductors, capacitors, and resistance.

SLU-PHY 107: General Practical Physics I (1 Unit C: PH 45)
Learning Outcomes At the end of the course, students should be able to:
1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors.
4. plot and analyse graphs; and 5. draw conclusions from numerical and graphical analysis of data.

Course Contents

This introductory course emphasises quantitative measurements, the treatment of measurement errors, and graphical analysis. A variety of experimental techniques should be employed. The experiments include studies of meters, the oscilloscope, mechanical systems, 100 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.

PHY 108- General Practical Physics II (1 Unit C: PH 45)

Learning Outcomes: On completion, the student should be able to:
1. conduct measurements of some physical quantities;
2. make observations of events, collect and tabulate data;
3. identify and evaluate some common experimental errors;
4. plot and analyse graphs;
5. draw conclusions from numerical and graphical analysis of data; and
6. prepare and present practical reports.

Course Contents

This practical course is a continuation of PHY 107 and is intended to be taught during the second semester of the 100 level to cover the practical aspect of the theoretical courses that have been covered with emphasis on quantitative measurements, the treatment of measurement errors, and graphical analysis. However, emphasis should be placed on the basic physical techniques for observation, measurements, data collection, analysis and deduction.

SLU-COS 104: Introduction to Application Packages (2 Units; C: LH 15, PH 90)

Learning Outcomes: At the end of this course, students should be able to;
1) Understand the concept of application packages and their role in modern computing.
2) Explore popular application packages across different domains.
3) Learn essential features and functionalities of application packages.
4) Develop practical skills in using application packages for various tasks.
5) Analyze case studies to understand the real-world applications of different application packages.

Course content

Overview of application packages, Importance and benefits, Evolution and trends in application packages. Productivity Suites, Introduction to productivity suites, Microsoft Office Suite (Word, Excel, PowerPoint, Outlook), Google Workspace (Docs, Sheets, Slides, Gmail), Features and functionalities comparison. Graphic Design and Multimedia Packages, Adobe Creative Cloud Suite (Photoshop, Illustrator, InDesign, Premiere Pro), CorelDRAW Graphics Suite, Basics of graphic design and multimedia editing. Introduction to project management tools. Trello, Asana, Basecamp, Collaboration tools: Slack, Microsoft Teams, Zoom. Accounting and Finance Software, QuickBooks, Sage Intacct, Introduction to accounting principles. Introduction to Enterprise Resource Planning (ERP), Oracle ERP Cloud, Overview of ERP systems, Importance and benefits of ERP in businesses. Specialized Application Packages, Industry-specific software (e.g., AutoCAD, MATLAB, SPSS), Healthcare management software, Legal practice management software, Overview and applications in specialized domains

Lab work: Practical exercises in graphic design software, Case studies on effective project management using tools, Hands-on exercises in accounting software

SLU-IFT 132: Introduction to Information System (3 Units: LH 45, P 45)

Learning Outcomes

At the end of this course,
Students should be able to:

1. Explain system concepts and organisational processes;
2. Explain information systems principles and application in modern organisation;
3. Describe information technology security and related ethical issues; and
4. Explain database management and system development life cycle.

Course Contents

Roles and relevance of information systems in organisations to conduct business and solve problems. Information systems principles in modern organisations. Systems concepts; organisational processes; technological aspects of information systems. The internet. Information technology security. Ethical issues. Database management. Systems development life cycle.

SLU-STA 112: Probability I (3 Units; C: LH 45)

Learning Outcomes

At the end of the course, students should be able to:

1. Explain the differences between permutation and combination;
2. Explain the concept of random variables and relate it to probability and distribution functions;
3. Describe the basic distribution functions; and
4. Explain the concept of exploratory data analysis.

Course Contents

Permutation and combination. Concepts and principles of probability. Random variables. Probability and distribution functions. Basic distributions: Binomial, geometric, Poisson, normal and sampling distributions; exploratory data analysis.

LEVEL 200 Courses

ENT 211: Entrepreneurship and Innovation (2 Units C: LH 15; PH 45)

Learning Outcomes

At the end of this course, students should be able to:

1. explain the concepts and theories of entrepreneurship, intrapreneurship, opportunity seeking, new value creation, and risk taking;
2. state the characteristics of an entrepreneur;
3. analyse the importance of micro and small businesses in wealth creation, employment, and financial independence;
4. engage in entrepreneurial thinking;
5. identify key elements in innovation;
6. describe stages in enterprise formation, partnership and networking including business planning;
7. describe contemporary entrepreneurial issues in Nigeria, Africa and the rest of the world; and
8. state the basic principles of e-commerce.

Course Contents

Concept of Entrepreneurship (Entrepreneurship, Intrapreneurship/Corporate Entrepreneurship,). Theories, Rationale and relevance of Entrepreneurship (Schumpeterian and other perspectives, Risk-Taking, Necessity and opportunity-based entrepreneurship and Creative destruction). Characteristics of Entrepreneurs (Opportunity seeker, Risk taker, Natural and Nurtured, Problem solver and change agent, Innovator and creative thinker). Entrepreneurial thinking (Critical thinking, Reflective Thinking, and Creative thinking). Innovation (Concept of innovation, Dimensions of innovation, Change and innovation, Knowledge and innovation). Enterprise formation, partnership and networking (Basics of Business Plan, Forms of business ownership, Business registration and forming alliances and joint ventures). Contemporary Entrepreneurship Issues (Knowledge, Skills and Technology, Intellectual property, Virtual office, Networking). Entrepreneurship in Nigeria (Biography of inspirational

Entrepreneurs, Youth and women entrepreneurship, Entrepreneurship support institutions, Youth enterprise networks and Environmental and cultural barriers to entrepreneurship). Basic principles of e-commerce.

GST 212: Philosophy, Logic and Human Existence (2 Units C: LH 30)

Learning Outcomes

At the end of this course, students should be able to

1. know the basic features of philosophy as an academic discipline;
2. identify the main branches of philosophy & the centrality of logic in philosophical discourse;
3. know the elementary rules of reasoning;
4. distinguish between valid and invalid arguments;
5. think critically and assess arguments in texts, conversations and day-to-day discussions;
6. critically asses the rationality or otherwise of human conduct under different existential conditions;
7. develop the capacity to extrapolate and deploy expertise in logic to other areas of knowledge, and
8. guide his or her actions, using the knowledge and expertise acquired in philosophy and logic.

Course Contents

Scope of philosophy; notions, meanings, branches and problems of philosophy. Logic as an indispensable tool of philosophy. Elements of syllogism, symbolic logic— the first nine rules of inference. Informal fallacies, laws of thought, nature of arguments. Valid and invalid arguments, logic of form and logic of content — deduction, induction and inferences. Creative and critical thinking. Impact of philosophy on human existence. Philosophy and politics, philosophy and human conduct, philosophy and religion, philosophy and human values, philosophy and character molding, etc.

COS 201: Computer Programming I (3 Units C1: LH 30; PH 45)

Learning Outcomes

At the end of this course, students should be able to:

1. identify different programming paradigms and their approaches to programming;
2. write programmes using basic data types and strings;
3. design and implement programming problems using selection;
4. design and implement programming problems using loops;
5. use and implement classes as data abstractions in an object-oriented approach;
6. implement simple exception handling in programmes;
7. develop programmes with input/output from text files; and
8. design and implement programming problems involving arrays.

Course Contents

Introduction to computer programming. Functional programming; Declarative programming; Logic programming; Scripting languages. Introduction to object-orientation as a technique for modelling computation. Introduction of a typical object-oriented language, such as Java. Basic data types, variables, expressions, assignment statements and operators. Basic object oriented concepts: abstraction; objects; classes; methods; parameter passing; encapsulation. Introduction to Strings and string processing; Simple I/O; control structures; Arrays; Simple recursive algorithms; inheritance; polymorphism. Lab work: Programming assignments involving hands-on practice in the design and implementation of simple algorithms such as finding the average, standard deviation, searching and sorting. Practice in developing and tracing simple recursive algorithms. Developing programmes involving inheritance and polymorphism.

COS 202: Computer Programming II (3 Units C1: LH 30; PH 45)

Learning Outcome
At the end of this course, students should be able to:
1. Demonstrate the principles of good programming and structured programming concepts;
2. Demonstrate string processing, internal searching, sorting, and recursion;
3. Demonstrate the basic use of OOP concepts: classes, objects, inheritance, polymorphism, data abstraction;
4. Apply the tools for developing, compiling, interpreting and debugging programmes; and
5. Demonstrate the use of syntax and data objects, operators. Central flow constructs, objects and classes programming, Arrays, methods, Exceptions, Applets and the Abstract, OLE, Persistence, Window Toolkit.

Course Contents
Review and coverage of advanced object-oriented programming - polymorphism, abstract classes and interfaces. Class hierarchies and programme organisation using packages/namespaces. Use of API – use of iterators/enumerators, List, Stack, Queue from API. Searching, and sorting. Recursive algorithms. Event-driven programming: event-handling methods, event propagation, exception handling. Applications in Graphical User Interface (GUI) programming.

Lab work:
Programming assignments leading to extensive practice in problem-solving and programme development with emphasis on object-orientation. Solving basic problems using 131 static and dynamic data structures. Solving various searching and sorting algorithms using iterative and recursive approaches. GUI programming.

IFT 203: Introduction to Web Technologies (2 Units C: LH 15; PH 45)
Learning Outcomes At the end of the course, the students should be able to:)
1. state the origin of the internet and the world wide web;
2. create simple web content using HTML, CSS, and JavaScript;
3. use simple application frameworks to develop web content; and
4. appraise the impact of the world wide web on people's lives over time.

Course Contents
Introduction to the internet, the World Wide Web (WWW), and web development. WWW as a platform for interactive applications, content publishing, and social services. The role of HTTP and HTTPS in the context of web applications. Roles and operations of web browsers and the webserver. Interacting with web applications through forms, and using style sheets to separate document structure and document formatting. Web development tools and frameworks. Build a simple website that: organises information effectively, uses valid HTML and CSS, and applies appropriate web standards from standards bodies such as W3C. HTTP communication protocol, the mark-up languages HTML, XHTML, and XML, the CSS and XSLT standards for formatting and transforming web content.Interactive graphics and multimedia content on the web, client-side programming using JavaScript. Impact of the world wide web on people's lives over time. Lab Work: Using simple form-based web applications; developing simple websites using web development tools and frameworks; using the mark-up languages HTML, XHTML and XML; using JavaScript.

IFT 205: Introduction to Information Technology (2 Units C: LH 30)
Learning Outcomes
At the end of the course, the students should be able to:
1. explain the history and development of information technologies;
2. describe information technology application domains;
3. identify information technology and its related disciplines;
4. analyse security, privacy, policy, and other social issues inherent in information technology; and

5. compare the fundamental structures of computer networks and the internet.

Course Contents
Introduction to computer software, hardware, and networking technologies. Information technology systems model. A brief introduction to information technologies – humancomputer interaction, information management; networking, platform technologies, programming, and web systems and technologies. Data versus information. History of information technology and the internet. Information technology application domains. Security, privacy, policy, and other social issues inherent in Information technology development and use. Future trends in information technology, problems on mining, visualisation, natural language processing, and Blockchain.

IFT 211: Digital Logic Design (2 Units C: LH 15; PH 45)
Learning Outcomes At the end of this course, students will be able to:
1. explain why everything is data, including instructions, in computers;
2. describe how negative integers, fixed-length numbers, and non-numeric data are represented;
3. convert numerical data from one format to another;
4. describe computations as a system characterised by a known set of configurations with transitions from one unique configuration (state) to another (state);
5. describe the distinction between systems whose output is only a function of their input (combinational) and those with memory/history (sequential);
6. describe a computer as a state machine that interprets machine instructions;
7. articulate that there are many equivalent representations of computer functionality, including logical expressions and gates, and be able to use mathematical expressions to describe the functions of simple combinational and sequential circuits; and
8. design the basic building blocks of a computer: arithmetic-logic unit (gate-level), registers (gate-level), central processing unit (register transfer-level), and memory (register transfer-level).

Course Contents
Introduction to information representation and number systems. Boolean algebra and switching theory. Manipulation and minimisation of completely and incompletely specified Boolean functions. Physical properties of gates: fan-in, fan-out, propagation delay, timing diagrams and tri-state drivers. Combinational circuits design using multiplexers, decoders, comparators and adders. Sequential circuit analysis and design, basic flip-flops, clocking and timing diagrams. Registers, counters, RAMs, ROMs, PLAs, PLDs, and FPGAs. Lab Work: Simple combinational gates (AND, OR, NOT, NAND, NOR); Combinational circuits design using multiplexers, decoders, comparators and adders. Sequential circuit analysis and design using basic flip-flops (S-R, J-K, D, T flip-flops); Demonstration of registers, counters, RAMs, ROMs, PLAs, PLDs, and FPGAs

IFT 212: Computer Architecture and Organisation (2 Units C: LH 15; PH 45)
Learning Outcomes
At the end of this course, students will be able to:
1. explain the organisation of the classical von Neumann machine and its major functional units;
2. construct simple assembly language programme segments;
3. describe how fundamental high-level programming constructs are implemented at the machine-language level;
4. discuss the concept of control points and the generation of control signals using hardwired or microprogrammed implementations;
5. describe how the use of memory hierarchy (cache, virtual memory) is used to reduce the effective memory latency; and
6. explain the concept of interrupts and describe how they are used to implement I/O control and data transfers.

Course Contents
Principles of computer hardware and instruction set architecture. Internal CPU organisation and implementation. Instruction format and types, memory, and I/O instructions. Dataflow, arithmetic, and flow control instructions, addressing modes, stack operations, and interrupts. Data path and control unit design. RTL, microprogramming and hardwired control. The practice of assembly language programming. Memory hierarchy. Cache memory, Virtual memory. Cache performance. Compiler support for cache performance. I/O organisations.

Lab work: Practical demonstration of the architecture of a typical computer. Illustration of different types of instructions and how they are executed. Simple Assembly Language programming. Demonstration of interrupts. Programming assignments to practice MS-DOS batch programming, Assembly Process, Debugging, Procedures, Keyboard input, Video Output, File and Disk I/O, and Data Structure. Demonstration of Reduced Instruction Set Computers. Illustration of parallel architectures and interconnection networks.

IFT 299: SIWES I **(3 Units C: PH 135)**
Learning Outcomes
At the end of this training, students should be able to:

1. assess their knowledge of cybersecurity, its application, preventive measures and defence of the cyber environment;
2. explain how a typical cybersecurity unit/department of an organisation operates;
3. describe the various assignments carried out and the skills acquired during the SIWES period; and
4. submit a comprehensive report on the knowledge acquired and the experience gained during the exercise.

Course Contents
Students are attached to private and public organisations for a period of three months during the second year session long break with a view to making them acquire practical experience and to the extent possible, develop skills in all areas of Cybersecurity. Students are supervised during the training period and shall be expected to keep records designed for the purpose of monitoring their performance. They are also expected to submit a report on the experience gained and defend their reports.

INS 202 Human-Computer Interface (HCI) (2 Units C: LH 15; PH 45)
Learning outcomes:
At the end of this course, students should be able to:
1. discuss the foundations and concept of the human-computer interface;
2. explain the principles of the human-computer interface;
3. explain the design and development of the human-computer interface; and
4. explain the importance of user feedback.

Course Contents
Foundations of HCI. The concept underlying the design of HCI. Principles of GUI. GUI toolkits. System design methods. User conceptual models and interface metaphors. Human cognitive and physical ergonomics. Human-centred software evaluation and development. GUI design and programming.

Lab Work: Illustration of the principles of HCI design. Practice on GUI design and programming. Demonstration of some GUI toolkits. Practical evaluation of GUIs

SLU-IFT 207 Information Technology in Bussiness **(2 Units C: LH 30)**
Learning outcomes
At the end of this course, students should be able to:
1. describe the fundamental concept of innovation and business idea

2. describe the system development process
3. describe business feasibility planning
4. understand business model

Course Contents
Fundamental concepts of innovation and business ideas in general. Product development. Business leadership. Digital marketing. Entrepreneurial opportunities in IT. Legal issues and business ethics. New venture creation process. Business feasibility planning. Market research. Business strategy. Business models and business plans. Technical presentations. Report on a successful entrepreneurial outfit.

SLU-IFT 214 Fundamentals of Networking (2 Units C: LH 30)
Learning objectives
At the end of this course, students should be able to:
1 Describe the function and operation of a hub, a switch and a router
2 Describe the function and operation of a firewall and a gateway
3 Describe the function and operation of Layer 2 switching, Layer 3 switching, and routing
4 Identify the layers of the OSI model
5 Describe the functionality of LAN, MAN, and WAN networks
6 Identify the possible media types for LAN and WAN connections
7 Explain Wi-Fi 6 and other Wi-Fi technologies
8 Describe network fundamentals and build simple LANs

Course contents
What is a network, types of network, WAN technologies, network topologies, the OSI Model, why a layered Network Model?, the seven layers of the OSI Model, network interface card, WAN—Physical Layer Implementations, MAC address, Multilayer switching,

SLU-IFT 216: IT Governance and Resource Management (2 Units: LH 30)
Learning Outcomes:
At the end of this course, students should be able to:
1. describe the role of IT in governance;
2. Understand the impact of IT on governance
3. understand system resource vendors
4. describe the procedure in managing system resource

Course contents
Introduction to IT governance, internet governance, role of IT governance and its effect on organizations, management issues in IT governance, organizational cultures and their impact on IT governance, resources needed for IT governance administration, vendors of system resources, naming conventions for the resources in a system, policies and procedures to manage resources in a system.

SEN 201: Introduction to Software Engineering (2 units C: LH 30)
Learning Outcomes: At the end of this course, students should be able to:
1. describe the concept of the software life cycle;
2. explain the phases of requirements analysis, design, development, testing and maintenance in a typical software life cycle;
3. differentiate amongst the various software development models;
4. utilise UML for object oriented analysis and design;
5. describe different design architectures;
6. explain the various tasks involved in software project management; and
7. describe the basic legal issues related to Software Engineering.

Course Contents
Software Engineering concepts and principles. Design, development and testing of software systems. Software processes: software lifecycle and process models. Process assessment models. Software process metrics. Life cycle of software system. Software requirements and specifications. Software design. Software architecture. Software metrics. Software quality and testing. Software architecture. Software validation. Software evolution: software maintenance; characteristics of maintainable software; re-engineering; legacy systems; software reuse. Software Engineering and its place as a computing discipline. Software project management: team management; project scheduling; software measurement and estimation techniques; risk analysis; software quality assurance; software configuration management. Software Engineering and law.

LEVEL 300 Course

GST 312: Peace and Conflict Resolution (2 Units C: LH 30)
Learning Outcomes At the end of the course, students should be able to:
1. analyse the concepts of peace, conflict, and security;
2. list major forms, types, and root causes of conflict and violence;
3. differentiate between conflict and terrorism;
4. enumerate security and peace building strategies; and
5. describe roles of international organisations, media, and traditional institutions in peace building.

Course Contents
Concepts of Peace, Conflict, and Security in a multi-ethnic nation. Types and Theories of Conflicts: Ethnic, Religious, Economic, Geo-political Conflicts; Structural Conflict Theory, Realist Theory of Conflict, Frustration-Aggression Conflict Theory. Root causes of Conflict and Violence in Africa: Indigene and settlers Phenomenon; Boundaries/border disputes; Political disputes; Ethnic disputes and rivalries; Economic Inequalities; Social disputes; Nationalist Movements and Agitations; Selected Conflict Case Studies – Tiv-Jukun; Zango Kataf, Chieftaincy, and Land disputes, etc. Peace Building, Management of Conflicts and Security: 72 Peace & Human Development. Approaches to Peace & Conflict Management --- (Religious, Government, Community Leaders, etc.). Elements of Peace Studies and Conflict Resolution: Conflict dynamics assessment Scales: Constructive & Destructive. Justice and Legal framework: Concepts of Social Justice; The Nigeria Legal System. Insurgency and Terrorism. Peace Mediation and Peace Keeping. Peace & Security Council (International, National, and Local levels) Agents of Conflict resolution – Conventions, Treaties Community Policing: Evolution and Imperatives. Alternative Dispute Resolution, ADR. a) Dialogue b). Arbitration, c). Negotiation d). Collaboration, etc. Roles of International Organisations in Conflict Resolution. (a). The United Nations, UN, and its Conflict Resolution Organs. (b). The African Union & Peace Security Council (c). ECOWAS in Peace Keeping. Media and Traditional Institutions in Peace Building. Managing Post-Conflict Situations/Crisis: Refugees. Internally Displaced Persons, IDPs. The role of NGOs in Post-Conflict Situations/Crisis

ENT 312: Venture Creation (2 Units C: LH 15; PH 45)
Learning Outcomes
At the end of this course, students, through case study and practical approaches, should be able to:
1. describe the key steps in venture creation;
2. spot opportunities in problems and in high potential sectors regardless of geographical location;
3. state how original products, ideas, and concepts are developed;
4. develop business concepts for further incubation or pitching for funding;
5. identify key sources of entrepreneurial finance;
6. implement the requirements for establishing and managing micro and small enterprises;

7. conduct entrepreneurial marketing and e-commerce;
8. apply a wide variety of emerging technological solutions to entrepreneurship; and
9. appreciate why ventures fail due to lack of planning and poor implementation.

Course Contents
Opportunity Identification (Sources of business opportunities in Nigeria, Environmental scanning, Demand and supply gap/unmet needs/market gaps/market research, Unutilised resources, Social and climate conditions, and technology adoption gap). New business development (business planning, market research). Entrepreneurial finance (venture capital, equity finance, microfinance, personal savings, small business investment organisations, and business plan competition). Entrepreneurial marketing and e-commerce (Principles of marketing, customer acquisition & retention, B2B, C2C and B2C models of e-commerce, first mover advantage, e-commerce business models and successful e-commerce companies,). Small business management/family business: Leadership & Management, basic bookkeeping, nature of family business and family business growth model. Negotiation and business communication (Strategy and tactics of negotiation/bargaining, traditional and modern business communication methods). Opportunity discovery demonstrations (business idea generation presentations, business idea contest, brainstorming sessions, idea pitching). Technological solutions (the concept of market/customer solution, customer solution, and emerging technologies, business applications of new technologies- Artificial Intelligence (AI), Virtual/Mixed Reality (VR), Internet of Things (IoT), Blockchain, Cloud Computing, renewable energy, etc. digital business and e-commerce strategies).

IFT 302: Web Application Development (2 Units C: LH 15; PH 45)
Learning Outcomes
At the end of the lecture, the students should be able to:
1. design and implement simple client-side and server-side web applications;
2. demonstrate hands-on skills in PHP and Python programming uses open-source software;
3. compare and contrast web programming with general-purpose programming; and
4. develop a fully functioning website and deploy it on a web server.

Course Contents
Introduction to framework-based web development using a contemporary language like PHP and ASP.net. Principles of web pages (dynamic and static) and website design. The tool used in web development. Client-side and server-side languages. Creation of interactive, dynamic websites using a common web architecture and object-based database access. Design, implementation, and testing of web-based applications including related software, databases, interfaces, and digital media. Standard object models, and the use of server-side programmes for database and file access; testing, software quality assurance; and the process of publishing Web sites. Hands-on PHP and Python programme using open-source software (Apache, PHP, Python, JavaScript, and MySQL). Programming for web development includes control structures, objects, functions, and the use of composite data types. Deploying dynamic content using JavaScript. Designing and developing dynamic web pages and creating, validating, transforming, and formatting data using PHP.

Lab Work: Simple PHP programming. Design of simple web pages. Creation of dynamic websites. Design of client-side and server-side programmes. Demonstration of web-based applications with database access. Use of JavaScript to develop dynamic content. Use of Python to develop dynamic web pages.

IFT 304: Web Development using Content Management Systems (2 Units C: LH 15; PH 45)
Learning Outcomes
At the end of the course, students should be able to:

1. develop a basic knowledge of web technology;
2. acquire skills necessary to develop and manage websites;
3. analyse Web content management techniques;
4. appraise the role of dynamic sites as the future of web design; and
5. convert a static design into a dynamic CMS-powered site.

Course Contents
Web development techniques using content management systems (CMS) (e.g., Joomla, MS SharePoint 2013). Design and creation of websites using specialised CMS tools. Review and evaluation of CMS tools and technologies in terms of client requirements.Development of Web sites using front-end (client-side) and back-end (server-side). Use of a CMS to set up, deploy, and maintain websites. Programming while considering issues of interface and user experience design, accessibility, and Web standards. Methods, languages, tools related to developing web-based content management systems. Development of plugins or extensions that integrate with existing systems to extend their functionality. Audit content for a website. Choose an appropriate CMS, and convert a static design into a dynamic CMS-powered site.

Lab Work: Basic features of Content Management Systems. Developing websites using CMS. Developing front-ends and back-ends. Using various tools in CMS. Developing plugins and extensions. Converting static designs to dynamic websites.

IFT 308: Ethics and Legal Issues in IT (2 Units C: LH 30)
Learning Outcomes
By the end of the course, the students should be able to:
1. describe laws and regulations related to ethics;
2. recall relevant codes of ethics for computing practice;
3. interpret consequences of violating ethical provisions;
4. explain the ethical issues associated with intellectual property; and
5. develop a strategy for resolving conflict in the workplace.

Course Contents
Social, ethical, legal, and managerial issues in the application of information technology in government, organisations, and industry. Foundations of intellectual property. Ownership of information. Plagiarism, Software piracy. Fairness in the workplace. Digital millennium copyright act. Patents. Trademarks and trade secrets. Legal issues in computing. Organisational context; professional and ethical issues and responsibilities. Relationships with professional societies. Codes of professional conduct. Ethics and history of ethics. Whistleblowing. Workplace issues (harassment, discrimination). Identify theft. Ethical hacking. Privacy and civil liberties organisations.

IFT 310: Mobile Application Development (2 Units C: LH 15; PH 45)
Learning Outcomes
At the end of the course the students should be able to:
1. identify the basic knowledge on mobile application environment and technology;
2. explain the concepts and processes of mobile application development;
3. discuss design and development issues specific to mobile applications;
4. design and develop mobile applications, using development tools and environments;
5. evaluate the performance of a mobile application and give its result; and
6. appreciate perspectives of mobile applications and their impact.

Course Contents
Introduction to developing mobile applications. Mobile operating systems capabilities, application architecture, and major components, such as activities, services, broadcast receivers, etc. Development

of interactive applications using widget libraries, web-based services. Basic concepts of 2D graphics and animation. An SQL database engine, and multithreading. Multiplatform mobile application development. Mobile application basics and features; Android application basics, UI design. Data storage; networking application design. Advanced application design (sensors, camera, GPS, Audio, etc.), graphics and games, web based hybrid application design. Design and implement a simple mobile application for a given mobile platform. Metrics and methods to evaluate the performance of mobile applications. Mobile application perspectives and impact.

Lab Work: Demonstration of a Simple Mobile Application. Design and Development of interactive mobile applications. Demonstration of multiplatform mobile application development. Development of Android applications including UI design and data storage design. Demonstration of advanced mobile application design. Illustration of metrics for measuring the performance of mobile applications.

IFT 322: IT Innovation and Entrepreneurship (2 Units C: LH 15, PH 45)
Learning Outcomes
At the end of this course, students should be able to:
1. explain business models;
2. identify some entrepreneurial opportunities available in IT;
3. describe business plan and business start-ups process;
4. explain business feasibility and strategy;
5. explain marketing strategies; and
6. discuss business ethics and legal issues.

Course Contents
Fundamental concepts of innovation and business ideas in general. Product development. business leadership. Digital marketing. Entrepreneurial opportunities in IT. Legal issues and business ethics. New venture creation process. Business feasibility planning. Market research. Business strategy. Business models and business plans. Technical presentations. Report on a successful entrepreneurial outfit.

IFT 342: Network Servers and Infrastructures (2 Units C: LH 15;PH 45)
Learning Outcomes
At the end of the course, the students should be able to:
1. analyse IPv6 networking concepts and practices for communications over VPNs;
2. explain the fundamental concept of Virtual Computing, Cloud Computing, VoIP;
3. demonstrate through practical examples how protocols are used to enable communication between computing devices connected;
4. list the opportunities of virtual computing service provision models, such as cloud computing for organisations; and
5. identify, connect and install applications on virtual servers.

Course Contents
IP networking concepts and practices for IPv6 addressing. DHCP and DNS in IPv.6 networks. Secure communication over VPNs, VoIP architecture. Concept of Virtual Computing, Cloud Computing, VoIP. Traffic monitoring and network connectivity between operating systems. Overview of latest technologies of IP networks and understand application-level services used in the internet. Multi-Protocol Label Switching (MPLS). VPN Secure Network Connectivity. VoIP Architecture. Network Neutrality.

Lab Work: Demonstration of IPv6 networks including DHCP and DNS configuration.Basics of VPNs. Simple applications of VPNs. Installation of applications on virtual servers. Monitoring traffic on virtual servers. Working with Multiple Servers. Balancing traffic on servers. Testing the security of VPNs. Illustration of VOIP architecture.

IFT 399: SIWES II **(3 Units C: PH 135)**

Learning Outcomes

Upon the completion of the training, the students should be able to:

1. interact with experts, thus making them gain extra knowledge outside the school environment;
2. compare classwork with real-life working experience in their various areas of specialisation;
3. determine their level of competence;
4. acquire the more practical knowledge and skills;
5. provide a detailed written report on their industrial experience; and
6. defend their project to a panel of examiners.

Course Contents

Students are attached to private and public organisations for a period of three months during the third year session-long break with a view to making them acquire additional practical experience in all areas of Cybersecurity over and above what is gained in CYB 299. Students are supervised during the training period and shall be expected to keep records designed for the purpose of monitoring their performance. They are also expected to submit a report on the experience gained and defend their reports.

CSC 229 Operating System **(3 Units C: LH 30; PH 45)**

Learning Outcomes

At the end of this course, students should be able to:

1. Recognise operating system types and structures;
2. Describe OS support for processes and threads;
3. Recognise CPU scheduling, synchronisation, and deadlock;
4. Resolve OS issues related to synchronisation and failure for distributed systems;
5. Explain OS support for virtual memory, disk scheduling, I/O, and file systems;
6. Identify security and protection issues in computer systems; and
7. use C and Unix commands, examine behaviour and performance of Linux, and develop various system programmes under Linux to make use of OS concepts related to process synchronisation, shared memory, mailboxes, file systems, etc.

Course Contents

Fundamentals of operating systems design and implementation. History and evolution of operating systems. Types of operating systems. Operating system structures. Process management: processes, threads, CPU scheduling, process synchronisation. Memory management and virtual memory. File systems; I/O systems; Security and protection; Distributed systems; Case studies.

Lab work: Practical hands-on engagement to facilitate understanding of the material taught in the course. All the process, memory, file and directory management issues will be demonstrated under the LINUX operating system. Also UNIX commands will be briefly discussed. Alternatively, hands-on exposure may be through the use of operating systems developed for teaching, like TempOS, Nachos, Xinu or MiniOS. Another possibility is through programming exercises that implement and simulate algorithms taught. Simulation of CPU scheduling algorithms, producer-consumer problem, memory allocation algorithms, file organisation techniques, deadlock algorithms and disk scheduling algorithms.

ICT 305: Data Communications Systems and Network **(3 Units C: LH 30; PH 45)**

Learning Outcomes

At the end of the course, the students should be able to:

1. identify various network services, characteristics, elements, standards, and technologies;
2. describe the layered architecture of computer networks and the operation of main protocols in the TCP/IP model;

3. identify, compare and contrast different techniques and design issues of core functions such as addressing, routing, internetworking, switching, multiplexing, error and flow control, medium access, and coding;
4. implement simple client-server applications using socket programming;
5. demonstrate the ability to set up a small network and properly configure network components including switches, routers, and services (such as RAS, FTP, DNS, Web, DHCP, POP3); and
6. explain potential threats to network resources and various security mechanisms.

Course Contents
Types and sources of data, simple communications network, transmission definitions, one way transmission, half-duplex transmission, transmission codes, transmission modes, parallel transmission, serial transmission, bit synchronisation, character synchronisation, synchronous transmission, asynchronous transmission, the efficiency of transmission, error detection methods and data compression. Protocols: Introduction to the network protocol. Seven Layer ISO-OSI standard protocols and network architecture. Transport protocols, session services protocols, and other protocols. Institute of Electrical and Electronics Engineering 802 standards. Error control and Data Compression: Forward Error Control; error detection methods; parity checking; linear block codes, cyclic redundancy checking; feedback error control, data compression, Huffman coding, and dynamic Huffman coding. Local Area Networks: medium access control techniques – Ethernet, token bus and token ring; LAN standards; fibre-distributed data interface, metropolitan area network. Peer-to-peer, Client-Server. Client-Server Requirements: GUI design standards, interface independence, platform independence, transaction processing, and connectivity, reliability, backup, and recovery mechanisms. Information Network Software; Features and benefits of major recovery mechanisms. Information Network Software: features and benefits of major Network Operating Systems. Network OS: (e.g., Novell NetWare, UNIX/LINUX, and OS/2 & Windows NT). TCP/IP and Network OS. INTERNET: Definition, architecture, services, internet addressing. Internet protocol, IPv4, IPv6. Internet programming, Intranet. System administration, and security issues.

Lab Work: Demonstration of simple communications networks. Illustration of applications at the various levels of the OSI model. Demonstration of different types of Local Area Networks (LANs). Illustration of Metropolitan Area Networks. Illustration of Error Detection and Error Correction techniques. Demonstration of Network Operating Systems.

SLU-IFT 304: Routing Protocol Concept (3 Units: LH 45)
Learning Outcomes
At the end of the course, the students should be able to:
1. describe types of routing and packet forwarding;
2. describe subnet masking
3. explain the concept of classless inter domain routing
4. describe mobile adhoc network routing protocols

Course Contents
Introduction to Routing and Packet Forwarding, Static and Dynamic Routing Protocols, Distance Vector Routing Protocols, RIPv1, VLSM and CIDR, RIPv2, EIGRP, Link-State Routing Protocols, OSPF, Detail Review of the Concepts of Classless Inter domain Routing (CIDR), Variable Subnet Masking (VLSM), introduction to multicast routing, Introduction to Mobile adhoc networks (MANETS) routing protocols (proactive, reactive and hybrid).

SLU-IFT 303: LAN, Switching & Internetworking (3 Units: LH 30; PH 45)
Learning Outcomes: At the end of this course, students should be able to:
1. describe routing protocols;

2. explain the difference network technologies design
3. discuss the Implementation of Data Link Protocols; and
4. describe IP Addressing Services for an Enterprise Network.

Course Contents
LAN Design, Technologies and Protocols to Design and Implement a Converged Switched Network; Configure a Switch for Basic Functionality; Configure, Certify, and Troubleshoot Virtual LANs, VTP, and Inter-VLAN Routing; Implement Spanning Tree (IEEE 802.1D, PVST+, RSTP, PVRST+), Implementing Inter-VLAN Routing, Wireless LANs (WLANs); Basic WLAN Access and Security, WAN Technologies and Devices, Internet Communications; Implement Data Link Protocols (PPP, ATM, Ethernet, Frame Relay, HDLC), Implement IP Addressing Services for an Enterprise Network (NAT and DHCP; IPv6 Addressing Concepts); Enterprise Network Design Implementation Issues.

SLU-CSC 309: Artificial Intelligence (2Units C: LH 15; PH 45)
Learning Outcomes: At the end of this course, students should be able to:
1. explain Artificial Intelligence(AI) fundamentals, concepts, goals, types, techniques, branches, applications, AI technology and tools;
2. discuss intelligent agents, their performance, examples, faculties, environment and architectures, and determine the characteristics of a given problem that an intelligent system must solve;
3. describe the Turing test and the "Chinese Room" thought experiment, and differentiate between the concepts of optimal reasoning/behaviour and human-like reasoning/behaviour;
4. describe the role of heuristics and the trade-offs among completeness, optimality, time complexity, and space complexity;
5. analyse the types of search and their applications in AI and describe the problem of combinatorial explosion of search space and its consequences;
6. demonstrate knowledge representation, semantic network and frames along with their applicable uses;
7. practice Natural Language Processing, translate a natural language (e.g., English) sentence into a predicate logic statement, convert a logic statement into clause form, apply resolution to a set of logic statements to answer a query; and
8. analyse programming languages for AI and expert systems technology, and employ application domains of AI.

Course Contents
Overview of Artificial Intelligence. History of AI. Goals of AI. AI Technique. Types of AI. Branches and applications of AI. Advantages and Disadvantages. Introduction to Intelligent Agents. Agent Performance, Examples of Agents, Agent Faculties, Rationality, Agent Environment. Agent Architectures. Search. General Classes of AI Search Algorithm Problems. Problem Solving by Search. Types of AI Search Techniques and Strategies. Introduction to the types of problems and techniques in AI. Problem-Solving methods. Major structures used in AI programmes. Knowledge Representation. KR and Reasoning Challenges. KR Languages. Knowledge representation techniques such as predicate logic, non-monotonic logic, and probabilistic reasoning. Semantic Network - types of relationships, semantic network inheritance, types and components. Introduction to Frames. Natural Language Processing (NLP). Introduction to natural language understanding and various syntactic and semantic structures. Introduction to Expert Systems - characteristics, components, types, requirements, technology, development. Programming Languages for AI. Introduction to computer image recognition.

Lab work: Group practical in (i) Turing test practical - Students can act out their own version of the Turing test (iii) Facial recognition practical to aid in teaching students how machine learning works with students simulating a facial recognition algorithm. Practical applications of NLP in groups – (i) Question Answering focuses on building systems that automatically answer the questions asked by humans in a natural language (ii) Spam detection application for detecting unwanted e-mails getting to a user's inbox

(iii) Sentiment analysis/opinion mining should be used on the web to analyse the attitude, behaviour, and emotional state of the sender, implemented through a combination of NLP and statistics (iv) Practical exercise of machine translation used to translate text or speech from one natural language to another natural language such as the Google Translator (v) Developing a model to provide word processor software for the spelling correction (vi) Developing a model for speech recognition for converting spoken words into text (vii) Implementing a Chatbot to provide the staff/student's chat services. OR Group Practical exercise on agents and its environment using simulation of a colony of ants foraging for food; model simulating a message between agents; model simulating the flocking behaviour of birds; model to apply standard search algorithm to the classic search problem of missionaries and cannibals, and how to use communicating agents for searching networks. Some computer AI animation exercises for any branch of AI. Practical exercise on simple robots coupling and programming. Group project of building a lawn robot for trimming grasses, or any simple design and implementation of robotics.

LEVEL 400 Courses

COS 409: Research Methodology and Technical Report Writing (2 Units C: LH 30)

Learning Outcomes

At the end of this course, students should be able to:

1. explain research, types, approaches and significance of research;
2. discuss statement of problem, research methods, methodology, research process, criteria and strategy for good research;
3. discuss scientific investigation, problem formulation, and technique of the research problem;
4. discuss the guidelines for constructing questionnaire/schedule, guidelines for successful interviewing, research proposal and research plan; and
5. explain types of reports, technical report writing, procedures and guidelines.

Course Contents

Foundations of Research. Types of Research. Research Approaches. Significance of Research. Research Methods versus Methodology. Research Process. Criteria and Strategy for Good Research. Problems Encountered by Researchers in Nigeria. Principles of Scientific Research. Scientific investigation. Problem formulation. Definition and technique of the Research Problem. Selection of Appropriate Method for Data Collection- Primary Data and Secondary Data. Guidelines for Constructing Questionnaire/Schedule. Guidelines for Successful Interviewing. Difference between Survey and Experiment. Eloping Research Proposal and Research Plan. Formulation of working hypothesis and Testing. Literature review. Procedure for reviewing related relevant studies and referencing cited works. Types of Reports. Technical Report Writing. Layout and mechanics of writing a Research Report. Standard Techniques for Research Documentation. Sampling Design. Different Types of Sample Designs. Steps in Sampling Design. Criteria of Selecting a Sampling Procedure. Methods of analysis. Processing and Analysis of Data Elements/Types of Analysis. Interpretation and Presentation of results. How to prepare References and Bibliography.

IFT 403: Mobile and Pervasive Computing (2 Units C: LH 15; PH 45)

Learning Outcomes:

At the end of the course, students should be able to:

1. describe the concepts of programming mobile devices and pervasive computing;
2. define open protocols and context-aware sensor networks;
3. evaluate techniques, needs, and requirements for pervasive systems; and
4. describe security protocols for sensor networks.

Course Contents

Definitions and motivations: mobile, pervasive and ubiquitous computing. Physical interaction. Theoretical foundations of pervasive computing. Context-aware interaction, resource and device constraints. Implementing pervasive systems: sensor, actuators, and embedded systems. Applications, programming languages, and approaches, device types, and choices. Capturing needs and requirements for pervasive systems: techniques and challenges. Multisensory communication using pervasive computing. Sensor Networks.Security Protocols for Sensor Networks. Introduction to cloud computing technologies and its services.

Lab Work: Developing simple mobile applications. Design of simple pervasive computer systems. Design of context-aware sensor networks. Testing the security of mobile and pervasive computer systems. Using security protocols for sensor networks.

IFT 410: System Integration and Architecture (2 Units C: LH 30)
Learning Outcomes:
At the end of this course, students should be able to:
1. discuss systems integration activities as a part of the development lifecycle;
2. explain and apply key systems integration architecture, methodologies, and technologies;
3. apply integration technologies to implement system integration solutions; and
4. describe Interplay between IT applications roll□out and related organisational processes.

Course Contents
System architecture, testing, evaluation, and benchmarking. Contracts, RFPs, and quality. System integration and deployment. System release. Pilot and acceptance testing and defect repair. System support strategies and user support plans, and enterprise integration approaches, standards, and best practices. Testing and quality assurance. Role of systems architecture in systems integration, performance, and effectiveness. Principles and concepts of DevOps. The interplay between IT applications roll□out and related organisational processes. The concept of Enterprise Architecture. Developing an Enterprise Architecture.

IFT 442: Wireless Communications and Networking (2 Units C: LH 15; PH 45)
Learning Outcomes
At the end of the course, students should be able to:
1. describe the principles underlying wireless data communications;
2. design and implement wireless network environment for any application using the latest wireless protocols and standards;
3. develop skills in diagnosing and troubleshooting PCs and wireless devices' problems;
4. develop hands-on experience installing, configuring, and upgrading wireless communications components and software;
5. describe the concepts of Packet switching cellular systems; and
6. describe the concept of mobility management and WPAN.

Course Contents
Fundamental principles underlying wireless data communications. Wireless transmission basics. Radio propagation issues, antennas, digital modulation. Spread spectrum techniques, and their applications, and popular standards. Wi-Fi, WiMAX, and Bluetooth. Practical knowledge in the design, testing, deployment, debugging, and commissioning of Wi-Fi, WiMAX networks, and point-to-point microwave systems. Cellular Concept and Spatial Reuse (Interference□Limited and Coverage□Limited Systems). Frequency Reuse (Cellular vs. WIFI - GSM: Architecture). Voice Support, UMTS: Basics of CDMA, Architecture and Key Channels. Introduction to LTE: History, Architecture. Uplink and Downlink Communication in LTE. Mobility in Cellular Systems: The Gateway Concept. Measurement Reports.

Mobility Procedures. Mobile IP: Basic Components, Tunnelling, Enhancements for Mobile Ipv6 - Wireless Personal Area Networks (PANS). Discussions on emerging cellular network technologies.

Lab Work: Basics on wireless transmission. Design of simple Wi-Fi and Wi-Max networks. Demonstration of GSM networks. Deployment and testing of wireless networks. Working with LTE. Demonstration of IPv6. Illustration of Wireless Personal Area Networks (PANS)

IFT 497: Final Year Project I **(3 Units C: PH 135)**

Learning Outcomes

At the end of this course, students should be able to:

1. identify a researchable project topic in cybersecurity, work on the introductory aspect, under the guidance of the supervisor;
2. review relevant recent literature pertinent to identified problem statement and establish the research gap;
3. acknowledge and reference sources of information used in the research report;
4. conceptualise and design a research methodology to address an identified problem;
5. determine tools for analysing data collected based on research objectives;
6. write a coherent proposal on the research project to be conducted; and
7. orally present the written project proposal.

Course Contents

An independent or group investigation of appropriate cybersecurity related problems carried out under the supervision of a lecturer. The student must submit a written proposal to the supervisor to review. The proposal should give a brief outline of the project with the statement of problem, aim, objectives, scope, significance, research gap, proposed research methodology, estimated schedule of completion, and resources needed. A formal written report is essential and an oral presentation may also be required. Topics from emerging trends such as applications in artificial intelligence, steganography, quantum computing, big data, cloud security, ethical hacking, cyber hunting, internet security, penetration testing, network intrusion and prevention, threat management, cybersecurity risk mitigation in the cloud, biometrics, digital image processing, Blockchain, quantum computing, edge computing, Internet of Things, 5G security, etc.

IFT 498: Final Year Project II **(3 Units C:PH 135)**

Learning Outcomes

Upon completion of the project, students should be able to:

1. demonstrate technical skills in Information Technology;
2. demonstrate generic transferable skills such as communication and team work.
3. produce a technical report in the chosen project;
4. defend the written project report; and
5. appreciate the art of carrying out full-fledged research.

Course Contents

This is a continuation of IFT 497. This includes the research methodology, analysis of data using statistical tools, performance evaluation, standard documentation of the project, referencing style, programming of the prototype/simulation model, plagiarism and grammarly check, and PowerPoint presentation skill. The formal written report made up of chapters four and five approved by the supervisor will be submitted to the Department for final grading. An oral presentation is required.

INS 401: Project Management **(2 Units C: LH 30)**

Learning Outcomes

At the end of this course, students should be able to:

1. describe project management planning;

2. describe project scheduling;
3. explain the management of project resources;
4. discuss project procurement, monitoring, and execution; and
5. explain project communication and time management.

Course Contents
Introduction to Project Management. The Project Management Lifecycle: Project management and systems development or acquisition, The project management context, Technology and techniques to support the project management lifecycle, and Project management processes. Managing Project Teams: Project team planning, Motivating team members, Leadership, power and conflict in project teams, and managing global project teams; Managing Project Communication and enhancing team communication; Project Initiation and Planning. Managing Project Scope: Project initiation, How organisations choose projects, Activities, and Developing the project charter; Managing Project Scheduling: Common problems in project scheduling, and Techniques for project scheduling; Managing Project Resources: Types of resources (human, capital, time), and Techniques for managing resources. Project quality and tools to manage project quality. Managing project risk and tools for managing project risk. Managing Project Procurement: Alternatives to systems development, External acquisition, Outsourcing-domestic and offshore, Steps in the procurement process, and managing the procurement process. Project Execution, Control, and Closure: Managing project execution, monitoring progress, and managing change, Documentation, and communication, and common problems in project execution; Managing Project Control and Closure: Obtaining information, Cost control, Change control, Administrative closure, Personnel closure, Contractual closure, and Project auditing.

SLU-IFT 402: Integrative Programming & Technologies (2 Units: LH 20; PH 30)
Learning Outcomes: At the end of this course, students should be able to:
1. desctibe scripting techniques and their roles in programming language
2. learn to write scripting language
3. understands design patterns and inheritance in programming language
4. describe software security practice

Course Contents
Scripting techniques – scripting and the role of scripting languages, creating and executing scripts, and influence of scripting on programming; integrative coding – design patterns, interfaces, and inheritance; software security practices – evidence–based security versus code access security, authentication to system resources and services, and encryption of data between systems and services; data mapping and exchange; intersystems communications – architectures for integrating systems, DCOM, CORBA, RMI, web services and middleware.

SLU-IFT 405: Enterprise Systems (2 Units: LH 20; PH 30)
Learning Outcomes: At the end of this course, students should be able to:
1. describe Information technology infrastructure and the systems;
2. explain implementation and management of enterprise information technology solutions
3. Describe Frameworks and strategies for infrastructure management

Course Contents
Information technology infrastructure and the systems that support the operational, administrative and strategic needs of an organisation. The design, selection, implementation and management of enterprise information technology solutions. Frameworks and strategies for infrastructure management, distributed computing, middleware, legacy system integration, system consolidation, software selection, total cost of ownership calculation, information technology investment analysis, and emerging technologies. Managing risk and security within audit and compliance standards.

SLU-IFT 404: Applied Network Security (3 Units: LH 30; PH 45)

Learning Outcomes: At the end of this course, students should be able to:
1. describe security technologies
2. Understands Network vulnerabilities on ISO layers
3. Understand the usage of Cryptography in security

Course Contents

This course introduces the networking and security technologies required to build and maintain a home or small-office network. Network security and cryptographic protocols. Network vulnerabilities, attacks on TCP/IP, network monitoring, security at the link, network and transport layers. Cryptography e.g. secret and public key schemes, message authentication codes and key management. WLAN security, IPSec, SSL, and VPNs. E-mail security (PGP, S/MIME), Kerberos, X.509 certificates, AAA and Mobile IP, SNMP security, firewalls, filters and gateways. Policies and implementation of firewall policies, stateful firewalls, firewall appliances. Network-related physical security, risk management and disaster recovery/contingency planning issues and housekeeping procedures. Network security from a manager's perspective. Threats, risks, and risk assessment. The basic concepts of data security: availability, confidentiality, authentication, non-repudiation. Network reliability, availability and downtime. Business continuity planning. Backup and hot sites, redundancy. Security policies, including acceptable use.

SLU-IFT 408: Information Assurance and Security (2 Units: LH 20; PH 30)

Learning Outcomes: At the end of this course, students should be able to:
1. describe security design principles
2. describe security implementation mechanisms
3. Describe security operational issues

Course Contents

History and terminology, security mind set, design principles, system/security life–cycle, security implementation mechanisms, information assurance analysis model, disaster recovery, and forensics; security mechanisms–cryptography, authentication, redundancy, and intrusion detection; operational issues–trends, auditing, cost/benefit analysis, asset management, standards, enforcement, legal issues; policy–creation of policies, maintenance of policies, prevention, avoidance, incident response (forensics), and domain integration (physical, network, internet, etc.); attacks – social engineering, denial of service, protocol attacks, active and passive attacks, buffer overflow attacks, and malware; security domains–security awareness and possible domains.

SLU-IFT 407: Database Design and Management (2 Units: LH 20; PH 30)

Learning Outcomes: At the end of this course, students should be able to:
1. describe database systems concepts and design;
2. explain database models and construction;
3. explain database implementation with SQL; and
4. describe database management and security.

Course Contents

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.

SLU-IFT 406: Wireless Communications and Networking (2 Units: LH 15; PH 45)

Learning Outcomes: At the end of this course, students should be able to:
1. describe the principles underlying wireless data communications;

2. design and implement wireless network environment for any application using the latest wireless protocols and standards;
3. diagnose and troubleshoot faulty PCs and wireless devices;
4. install, configure and upgrade wireless communications system; and
5. develop hands-on experience installing, configuring, and upgrading wireless communications components and software.

Course Contents
Fundamental principles underlying wireless data communications. Wireless transmission basics. radio propagation issues. antennas. digital modulation. spread spectrum techniques and their applications. Popular standards: Wi-Fi, WiMAX and Bluetooth. Also presents practical knowledge to enable the design, testing, deployment, debugging and commissioning of Wi-Fi, WiMAX networks, and point-to-point microwave systems. Discussions on cellular network technologies are also included.

Lab Work: Basics on wireless transmission. Design of simple Wi-Fi and Wi-Max networks. Demonstration of GSM networks. Deployment and testing of wireless networks. Working with LTE. Demonstration of IPv6. Illustration of Wireless Personal Area Networks (PANS)