COMPUTER STUDIES

GENERAL OBJECTIVES

The aim of the Unified Tertiary Matriculation Examination syllabus in Computer Studies is to prepare the candidates for the Board's examination. The objectives of the syllabus are designed to test candidates' understanding, knowledge and acquisition of:

1. Evolution of Computing Systems
2. Basic concepts of computer and its operations
3. Problem solving skills, data processing and practical skills in Computing
4. System software and Application Software.
5. Operations of Basic computer hardware – Input, Output, Memory and Central Processing Unit
6. Application of Online resources and Online skills
7. Ethics and human issues in computing
8. Career Prospects in Computing

The syllabus is divided into nine sections as given below:

A. Evolution of Computing
B. Fundamentals of Computing
C. Computer Application Packages
D. Managing Computer Files
E. Computer Maintenance and Safety Measures
F. Information & Communication Technology (ICT)
G. Developing Problem-Solving Skills
H. Artificial Intelligence (AI) and Robotics
I. Computer Ethics and Human Issues
.

DETAILED SYLLABUS

SECTION A: Evolution of Computing

TOPICS/CONTENTS/NOTES	OBJECTIVES
1. **History of computing** a. Pre-Computing Age - 19th century Features and components early computing devices b. Computing Devices - 20th Century c. The history behind each device	Candidates should be able to: i. Identify the various computing devices since the beginning of counting/computing - Abacus - Slide Rule - Napier's Bones - Pascal Calculator - Leibnitz Multiplier - Jacquard Loom - Charles Babbage's Analytical Engine - Hollerith Census machine and - Burrough's machine.

TOPICS/CONTENTS/NOTES	**OBJECTIVES**
2. **Classification of computing devices** a. By Generation b. By Size c. By Purpose d. By Type	ii. Discuss the contributions and uses of each of the founders of these devices: - ENIAC - EDVAC - UNIVAC 1 - Desktop Personal Computers, etc i. Candidates should be able to: Relate each generation with its characteristic feature. - First, Second, Third, Fourth to current generation. ii. Describe each generation under the following: - Year of Development - Basic components/Type of Technology - Speed of operation - Storage Capacity/Component iii. Explain the differences in the classification of computing systems by size (micro, mini, mainframe, and super)

	iv. Differentiate among the various types of modern computer systems and basic in respect of sizes components, data and usage - Personal Computers - Desktops - Laptops - Tablets - Hand-held - Servers - Workstations - Mainframes - Wearable - Super Computers. - Digital - Analog - Hybrid - Special purpose - General purpose etc. v. State the importance and use of these computing systems

SECTION B: Fundamentals of Computing

TOPICS/CONTENTS/NOTES	OBJECTIVES

Overview of Computing Systems **1.** a. Two main constituents of a computer (hardware and software) b. Characteristics of computers c. Type, examples and uses of computer hardware d. Logic Circuits e. Types, examples and uses of software	Candidates should be able to: i. Define Computer system in relation to its nature and programmability ii. List functional parts of computer systems iii. Explain the characteristics of computers (Electronic, Accuracy, Speed, interactive, Reliability, Consistency, Large Storage etc.) iv. Identify the differences between hardware and software Candidates should be able to: i. Define and give examples of hardware devices ii. List components of computer hardware, their functions and different types -Central Processing Unit, Peripherals (Input and Output devices) and Storage media iii. Explain the differences between input and output devices iv. Explain the functions of major input devices and give examples of the major input devices (keyboards, mouse, scanner, joystick, light pen, voice, digital camera, etc.) v. Explain the classification of keys on the keyboard (function, numeric, alphabetic, cursors. vi. Explain the features, functions and operations of the mouse vii. Explain the differences among keyboard, mouse, light pen and scanner, digital camera and output devices viii. Define and give examples of output devices (monitor, printer, speaker, plotters) ix. List the different types, features and uses of each output device above. x. Explain the similarities and differences among inkjet, laser and line printers xi. List the components of CPU – Arithmetic and Logic Unit (ALU), Control Unit (CU) and Registers. xii. Explain the functions of ALU, CU and Registers. xiii. Distinguish between Primary and Secondary Memory (Storage) units xiv. List the components of Primary Memory Unit (Random Access Memory (RAM), Read Only Memory (ROM)) xv. Explain the uses and differences between RAM and ROM

TOPICS/CONTENTS/NOTES	OBJECTIVES
	xvi. Explain the functions of secondary (auxiliary) storages xvii. List different types of secondary storages xviii. Give examples of secondary storages (Floppy disks, magnetic tape, hard disks, compact disk (CD), Digital Video Disk (DVD),USB, etc.) xix. Carry out comparative analysis of auxiliary storage devices in respect of size, speed, cost and technology (access mode, component, etc.). xx. List different units by which storage are measured and their relationships - bits, bytes, nibbles, words, kilobytes, megabytes, gigabytes, terabytes etc. xxi. Relate the relationships between Micro, Mega, Giga, and Terra bytes. Candidates should be able to: i. Define - Registers - Bus - Address ii. Explain the functions of the following Registers: - MDR (Memory Data Register)) - MAR (Memory Address Register) - MBR (Memory Base Register) - AC (Accumulator) - PC (Program Counter). - CIR (Current Instruction Register), etc. iii. Explain the differences between register and main memory iv. State the major steps involved in how a computer converts data to required information (Input – Process – Output) v. Enumerate factors affecting speed of data transfer (bus speed and bus width) Candidates should be able to: i. Define different type types and uses of gates: AND, NOT, OR, NOR, NAND ii. Interpret Logic equations for AND, NOT and OR gates iii. List the symbols of AND, NOT and OR gates iv. Construct Truth Table for standard logic gates – AND, NOT, OR. gates v. Define comparator vi. Construct a simple comparator with XOR (Exclusive OR) and NOR gate

TOPICS/CONTENTS/NOTES	**OBJECTIVES**

	Candidates should be able to: i. Differentiate between system and application software. ii. List different types of System software (Operating Systems, Utility Software, Middleware, Device Drivers, Translators, etc.) iii. Define Operating System (OS) iv. List functions of OS v. List different types of OS User Interfaces (Text (Command Line and Menu) and Graphical User Interface (GUI)) vi. Give examples of Operating Systems (MS Windows, LINUX, UNIX, etc.) vii. Discuss different OS on phones, iPad (Android, Blackberry, iPhone, etc.) viii. Define Utility Software ix. List functions of Utility Software x. List different types of Utility Software xi. Give examples of Utility Software (Editors, Anti-Virus, etc.) xii. Define Translators xiii. Explain the functions of Translator Software xiv. List the different categories of translators (Interpreter, Assembler and Compiler) xv. Explain the differences among the categories of translators. Candidates should be able to: i. List examples of application software and their usage ii. Differentiate between open source and proprietary software iii. Different methods of acquiring Application software (Built in house and Off the Shelf) iv. Explain the differences between User Application program and general-purpose Application packages v. Give examples of common off the Shelf Application packages and their examples. - Word Processing (MS Word) - Spreadsheet (Excel) - Database (Access) - Presentation (PowerPoint) - Graphics (Adobe Photoshop) - Accounting (Sage) - Payroll (Sage) - Government (Remita) - Banking (Fusion Banking Essence) - Statistics (SPSS) - Educational (SchoolShell) - Hospital (eHospital), etc.

TOPICS/CONTENTS/NOTES	**OBJECTIVES**

2. Data and Information and a. Differences between Data and Information b. Data representation. c. Methods of Digitisation	Candidates should be able to: i. Define data and information ii. List properties of information Candidates should be able to: i. List different types of data types (integers, real numbers, strings, multimedia (image, audio/visual, signal etc.) ii. Identify ways of representing and handling data, that is number bases with special reference to binary, decimal, hexadecimal etc. Candidates should be able to: i. Define digitization ii. Explain the process of digitalization(manual, heads-up, interactive tracing, automatic) iii. List different formats of digitized data (image, audio, video, motion, text, multimedia, etc.)

SECTION C: Computer Application Packages

TOPICS/CONTENTS/NOTES	OBJECTIVES
1. Word Processing package (a) General concept (b) Creating and saving documents (c) Editing, formatting and insertion (d) Printing (e) MS Word i. Features ii. Launch MS Word iii. Basic operations iv. Other operations	Candidates should be able to: i. Define word processing, and give examples of word processing packages. (MS Word, WordStar, WordPerfect, Open Word, etc.,) ii. Identify features of Word Processing packages in general (create, save, edit, insert, print, share etc.) iii. List the application areas of Word Processing packages (Office, Publishing, Journalism, Education, etc.) Candidates should be able to: i. Launch effectively MS word. ii. Perform MS Word basic operations - create, edit, save, retrieve, print, copy and move, etc. iii. Use different types and sizes of fonts iv. Perform MS Word operations of: v. Format, justify, search/explore, etc. - Carry out spell checking and file merging operations vi. Close MS Word.

TOPICS/CONTENTS/NOTES	**OBJECTIVES**

2. Spreadsheet package (a) General concept (b) Creating and saving documents (c) Editing, formatting and insertion (d) Printing (e) MS Excel i. Features ii. Launch MS Excel iii. Basic operations iv. Other operations	Candidates should be able to: i. Define Spreadsheet and give examples of Spreadsheet packages. (MS Excel, VisiCalc SuperCalc, SPSS, Calc etc.) ii. Identify features of Spreadsheet packages in general (Environment, Status bar, menu bar, formula bar, etc.) iii. List the application areas of Spreadsheet packages (Accounting, Engineering, Statistics, Calculation, what- if -scenarios, Education, etc.) Candidates should be able to: i. Launch effectively MS Excel. ii. Define basic terms in MS Excel -worksheet, workbook, cells, cell ranges, etc. iii. Use MS Excel to: create, edit, save, retrieve, and print spreadsheet documents. iv. Use data types in MS Excel (Number, Labels, Formula etc.) v. Perform basic operations in MS excel -Data Entry, Saving, Retrieve, move, copy, etc.) vi. Perform arithmetic calculations using formula and inbuilt functions, etc. vii. Use different types and sizes of fonts viii. Perform additional MS Excel operations (Formatting, Editing, Printing, Drawing charts etc.) ix. Close MS Excel.
3. (a) **Database package** (b) Definition of Database and examples of database packages (c) Database organizations (d) Different features of database format (e) Basic operations of Database using MS Access (f) Create database using MS Access	Candidates should be able to: i. Define Database and give examples of Database packages. (Dbase, Foxbase, MS Access, Oracle, etc.) ii. Define basic database terms (File, Record, Field, key, form, table, etc.) iii. List and explain different types of database organisation (Hierarchical, Network and Relational.) iv. List the application areas of Database in different organizations (Office, Home, Education, Government, Hospital, Agriculture, etc.)

Carry out operations on existing database using MS Access.	
TOPICS/CONTENTS/NOTES	**OBJECTIVES**

	Candidates should be able to: i. Explain different features of database format in MS Access: - Files designed as tables - Tables comprising of rows and columns - Row containing related information about a record - Column containing specific type of information about a field ii. Carry out steps to create a database in MS Access to: - Define structure of a database - Indicate field type (numeric, character, data, text, etc.) - Enter data - Save data iii. carry out basic operations on an already created MS Access database: - searching, modifying, sorting, reporting, selecting, inserting, etc. iv. Close the MS Access database.
4. **Graphics Package** (a) Definitions and examples of Graphic packages (b) Features of CorelDraw (c) Simple design using CorelDraw	Candidates should be able to: i. Define Graphics and give examples of Graphic packages (Paint, Harvard Graphics, Photoshop, CorelDraw, Autocad etc) ii. Explain features of CorelDraw (LiveSketch Tool, Multi-Monitor, Healing Clone Tools, Copy Curve Segments, Gaussian Blur Feature, Touch-Friendly GU Interface, Powerful Stylus Enhancements, Import Legacy Workspaces, Prominent Interactive Sliders, Custom Node Shapes, Font Filtering and Search, Corel Font Manager, Enhanced Vector Previews, Handles and Node etc.) iii. Use features of CorelDraw to activate existing CorelDraw file iv. Use CorelDraw to design - Business Card - School Logo - National Flag - Invitation Card - Certificates etc.

TOPICS/CONTENTS/NOTES	**OBJECTIVES**

5. **Presentation Package** (a) Definition of Presentation package and examples of Presentation packages (b) PowerPoint i. Features of PowerPoint Environment ii. Steps in activating an existing PowerPoint iii. PowerPoint operations	Candidates should be able to: i. Define Presentation and give examples of Presentation packages (MS PowerPoint, Windows Movie Maker, Micromedia Flash, impress, Apple keynotes, etc.) ii. Explain features of PowerPoint Environment (Animation Painter, Video Editor, create a video of you presentation, Automatic Ribbons Toolbars, Transitions, Sections, Cropped Tool, Mask Feature, Effective Preview, Screen Shot, Smart Guides,) iii. Explain steps in activating a PowerPoint presentation iv. Perform PowerPoint operations to: - Create new presentation - Insert pictures, text, graphs, animated contents, add new slide etc. - Save presentation, run slide show, print presentation, close presentation etc.
6. **Web Design Package** (a) Definition and examples of Web Design Packages (b) Uses Web Design Packages (c) Elements of Web design using Dreamview	Candidates should be able to: i. Define and Give examples of Web design package (HTML, XML, Dreamweaver, Rapidweaver, Google Web Designer, Microsoft Sharepoint Designer, Net Object Fusion, Xara Web Designer etc.) ii. List Elements of Web Design - Navigation - Visual design - Content - Web friendly - Interaction - Information Accessibility - Intuitiveness - Branding - Turnaround time - Conversion etc. iii. Use Dreamweaver for: - Social Media Management - Social Media Marketing - Website Design & Web Development - Pay Per Click (PPC) Management and Advert Consulting etc. ,

SECTION D: Managing Computer Files

TOPICS/CONTENTS/NOTES	OBJECTIVES
1. Concept of Computer Files (a) Definitions of basic terms (b) File organisations (c) Methods of accessing files (d) File classifications (e) Criteria for classifying files	Candidates should be able to: i. Define some basic terms (File, record, field, data item etc.). ii. Identify and use of basic data types (numeric, alphabetic, and alphanumeric) iii. Explain the relationship among file structure items (Data item – field - record-file-database) Candidates should be able to: i. Classify files according to how they are organised. (Serial, Sequential, Index and random) ii. Access files as appropriate (Serial, Sequential and Random). iii. Classify files into: - Master - Transaction - Reference iv. Explain the criteria used in classifying files - Nature of content (Program and Data) - Organization method - Storage medium - Date - Size etc.
2. Handling Computer Files (a) Basic operations (b) Data Loss (c) Security (d) Computer versus manual files	Candidates should be able to: i. Perform basic file operations - Create, Delete, Retrieve, Insert, Copy, View, Update, Open, Close etc. ii. Identify causes of data loss - Overwriting - Inadvertent deletion - Hardware malfunction - Virus attack - Theft - Arson - Natural Disaster etc. iii. Use different methods of securing data and maintaining its integrity - Backup - Antivirus

TOPICS/CONTENTS/NOTES	**OBJECTIVES**

	- Personal Identification Number - Biometrics - Passwords - Proper labelling of storage devices - CCTV - Physical Security - Fire Extinguisher - Smoke Alarms - etc. v. Compare the advantages and disadvantages of computer and manual file (security, speed of access and creation, cost of setup and maintenance, electricity supply, etc.)

SECTION E: Computer Maintenance and Safety Measures

TOPICS/CONTENTS/NOTES	OBJECTIVES
1. Booting and shutting down process	Candidates should be able to: i. Define booting ii. List the two types of booting process (cold and warm booting) iii. Explain the difference between cold and warm booting. iv. Explain the steps involved in booting and shutting down a computer system
2. Computer Maintenance	Candidates should be able to: i. Perform general cleaning of the computer system ii. Charge and replace battery for portable systems and UPS iii. Clean drive lens iv. Perform simple hardware and software maintenance v. Recover data from a crashed system
3. Computer Room Management	Candidates should be able to: i. Define proper sitting arrangement ii. Position the monitor, keyboard, CPU, Mouse and other peripherals appropriately iii. Ensure Proper illumination of the computer room iv. Maintain a dust free environment v. Keep liquid away from computer room vi. Keep strictly to laboratory rules and regulations

SECTION F: Information & Communication Technology (ICT)

TOPICS/CONTENTS/NOTES	OBJECTIVES
1. **Communication Systems** (a) Definitions and Acronym of ICT (b) Types and examples of ICT	Candidates should be able to: i. State the full meaning of the acronym ICT ii. Define ICT iii. List types of ICT. - Broadcasting - Telecommunication - Data Network - Information Systems - Satellite Communication, etc. iv. Give examples of Broadcasting - Radio broadcasting - Television Broadcasting - Satellites Broadcasting etc. v. List types of Telecommunications - Public Switched Telephone Network (PSTN Land Line - Mobile phone system - Circuit Switched Packet Telephone System (CSPT) - Satellite Telephone System - Fixed Wireless Telephone System etc, vi. List types of Data Network - Personal Area Network (PAN) - Local Area Network (LAN) - Metropolitan Area Network (MAN) - Wide Area Network (WAN) - Intranet - Internet etc. vii. List types of Information System - Data Processing System - Global Positioning System (GPS), etc.
2. **Application areas of ICT** (a) Application areas (b) ICT based Devices	Candidates should be able to: i. Define Applications Areas of ICT: - Teleconferencing - Video conferencing - Telecommuting - Telecomputing - Messaging - Information search, retrieval and archival systems - E-Learning - Telemedicine - E-Commerce - E-Government - E-Library, etc. .

TOPICS/CONTENTS/NOTES	**OBJECTIVES**

	ii. List types of ICT Devices: - Mobile phones - Computers - Automated Teller Machines (ATM) - Dispensing Machines - Point of Sale Machines - Automated Cash Register (ACR) - Radio sets - Television sets - Scanners, etc. Candidates should be able to:
3. Internet (a) Definition of terms (b) Internet Browsers (c) Features of Internet Browsers (d) Internet Services	i. Define Internet ii. Define and illustrate use of: - Home page - Browse - Browser - Chatroom - Cybercafe - Http - Html - ISP - Webpage - Website, etc. iii. Access the Internet through any of the browsers - Internet Explorer - Opera - Firefox - Cometbird - Ubuntu - Google Chrome - Phoenix, etc. iv. Explain features of the Internet Browsers - Title Bar - Menu Bar - Tool Bar - Address Bar - Icons - Search Bar - Uniform Resource Locator (URL)/Hypertext link, etc. v. Describe the use of different types of Internet services: - Electronic Mail (e-mail) - E-mail Discussion Group - Instant Messaging/Chats - Virtual meeting platforms - File Transfer Protocol (FTP) - World Wide Web (WWW) - Search Engines - Chatting etc.

TOPICS/CONTENTS/NOTES	**OBJECTIVES**

4. **Electronic Mail** (a) Definition (b) E-mail Service (c) Steps involved in creating and opening mail (email box, and chatting) (d) Features of e-mail address	Candidates should be able to: i. Define Electronic Mail and Chatting ii. List e-mail services: - Creating e-mail address - Composing e-mail - Sending/receiving e-mail - Adding attachments - Chatting - Creating mailing list/group - etc. iii. Explain the features in an e-mail address e.g. xyz@jamb.org.ng (user@Domainname) Explain the components of domain name.
5. **Networking** (a) Definitions (b) Network types (c) Network topologies (d) Network devices	Candidates should be able to: i. Define computer network ii. List and define various types of Networks: - PAN - LAN - WAN - MAN - Intranet - Extranet - Internet iii. Explain the differences in basic network topologies: - Star - Bus - Ring iv. Define and explain the use of network devices: - Hub - Modems - Switches - Routers - Gateway - Repeaters - Access Points Interface (API) - Network Interface Card (NIC), etc.
6. **World Wide Web (www)** (a) Definition and full meanings of acronyms (b) Brief history of WWW (c) Basic terminologies	Candidates should be able to: i. Give full meanings of www, HTTP, HTTPS, HTML, XML ii. Explain the history behind www iii. Explain basic terminologies: - www - Website - Webpage - Homepage - Protocol etc.

(d) Protocols	
TOPICS/CONTENTS/NOTES	**OBJECTIVES**

(e) Advantages and disadvantages of www. (f) Navigation through websites (g) Software for web development (h) Differences between email and website **7.**	iv. Define Protocol and list different types of protocols (http, https, ftp, etc.) v. List uses and benefits of www. - Accessible from anywhere around the globe with the availability of the Internet - access to information or make information accessible to the world - connect to people from anywhere from home - purchase products online anywhere in the comfort of your home - create website for your business and do a lot much more than physical office - communicate with anyone around the world through texts, chats, and emails. - Online course can be completed using www. - Online marketing and branding of businesses - Facilitate establishing professional contacts - Unlimited access to information, etc. vi. List disadvantages of www - Risk of data and identity theft - Cyberbullying - Easy spread of fake news - Hacking - Spam mails - Paedophile, etc. - vii. Navigate through websites. iv. - www.jamb.org.ng v. - www.waec.org.ng vi. - www.neco.org.ng vii. - www.ui.edu.ng viii. - www.jgiyc.com ix. - www.google.com, etc. x. Use of software for web development - Frontpage - WordPress - Dreamweaver - Photoshop - Google Web Designer, etc. xi. Differentiate between email and website - xyz@jamb.gov.ng and - www.jamb.org.ng Candidates should be able to: i. Identify different network cables and connectors:

Cables and Connectors (a) Network cables and connectors	
TOPICS/CONTENTS/NOTES	**OBJECTIVES**

(b) Computer cables and connectors	- Cables (Twisted Pair, Coaxial, Fibre Optics, etc.) Connectors (RJ45, RJ11, T-Connectors ii. Identify different types of Computer Cables and Connectors - Cables: Power Cables, Data Cables, Printer Cable, Universal Serial Bus (USB), Monitor Cable, Serial Cable, Parallel Cable, etc. - Connectors: Male and Female.

SECTION G: Developing Problem-Solving Skills

TOPICS/CONTENTS/NOTES	OBJECTIVES
1. **Programming Language (PL)** (a) Definition and Classification of PL (b) Advantages and disadvantages of different levels of PL	Candidates should be able to: i. Define Programming Language (PL) ii. Identify different classifications of PL. - Machine Language: interpreted directly in hardware i.e., binary machine code - Assembly languages: thin wrappers over a corresponding machine language i.e., Assembly Language/symbolic language. - High-Level languages: anything that are machine independent i.e., BASIC, C, Java, Fortran 2008, Python, Pearl etc. iii. Give advantages and disadvantages of Machine Language, Assembly Language and High programming Language.
2. **High Level Languages (HLL)** (a) Classifications of HLL (b) Characteristics of HLL (c) Translators	Candidates should be able to: i. Classify High-Level programming Languages into: - Scientific - General Purpose - Business - Object oriented - Procedural - Artificial Intelligence - String processing - Domain Specific - Scripting - Systems - Visual - Esoteric, etc.

TOPICS/CONTENTS/NOTES	**OBJECTIVES**

	ii. Explain the characteristics of High Level Programming Languages: - Requires translation into machine language - Portable - Easier to read, write and maintain as commands are similar to English - Use data types and data structures, selection statements and repetition/iteration constructs - Use logic operators and functions that are built into the language. - Programmers friendly - Easy to code, debug and maintain iii. Define translators and its two basic types: - Interpreters - Compilers
3. **Algorithm and Flowcharts** (a) Definitions (b) Functions of Algorithm (c) Properties of Algorithm (d) Flowchart symbols	Candidates should be able to: i. Define Algorithm and Flowchart ii. State functions of algorithms: They are used to perform: - Calculations - Data Processing - Automated reasoning etc. iii. State and explain the properties of Algorithm - Input specified - Output specified - Definiteness - Effectiveness - Finiteness etc. iv. Identify Flowchart symbols - Start - Input/Output - Process - Decision - Stop - loop - Continuation etc. v. Draw Flowchart of a given programming problem
4. **Programming Language Structure**	Candidates should be able to: i. Identify features/syntax of a programming language - Keywords

(a) Basic Statements	
TOPICS/CONTENTS/NOTES	**OBJECTIVES**

(b) Arithmetic/string operators (c) Subunits (d) Primitive and non-primitive data	- Variable types - Constants/literals - Numeric - String/alphanumeric - Basic characteristics of the language ii. Basic statements of a high-level programming language - Input - Output - Processing - Comments - Subunits (Functions, Procedure, Methods, Subroutines etc.) - Statements (Iteration/Loop, Conditional, Assignment, Dimension, etc.) iii. Arithmetic operators and expressions iv. String operators and expressions v. Built in functions vi. Primitive data (Integer, float, Boolean, character, etc.) vii. Non-Primitive Data Types (Arrays, classes, string, etc.) viii. Complex data structures (Trees, graphs, linked lists, objects etc.)
5. Program Development (a) Definition (b) Characteristics of programs (c) Precautions (d) Steps involved in developing program	Candidates should be able to: i. Define a program ii. List characteristics of a good program - Accuracy - Readability - Maintainability - Efficiency - Generality - Clarity etc. iii. State the precautions required in the development of a program - Be stable, steady and patient - No step skipping - Follow order of execution etc. iv. Steps involved in program development - Problem definition - Problem analysis - Design (Flow charting/ algorithm) development - Program coding - Program compilation - Program testing/debugging - Program documentation - Programme Maintenance v. Examples of:

TOPICS/CONTENTS/NOTES	**OBJECTIVES**

6. **System Development Life Cycle (SDLC)** (a) Definition of SDCL (b) Stages of SDLC	- Interpreted program (BASIC, java, python) - Compiled Program (COBOL, FORTRAN, C, C++, Java etc.) Candidates should be able to: i. Define SDLC ii. Describe SDLC iii. Explain stages in SDLC - Preliminary study (Identification of the problem, Recognition of the Need) - Feasibility - Analysis - Design - Implementation (coding, testing, documentation and delivery) - Maintenance - Review iv. Draw diagram of a SDLC

SECTION H: Artificial Intelligence (AI) and Robotics

TOPICS/CONTENTS/NOTES	OBJECTIVES
1. **Definition of AI** **2.** **Branches of AI** **3.** **Applications of AI**	Candidates should be able to: i. Define AI ii. Identify branches of AI - Machine Learning (supervised, unsupervised, reinforcement) - Neural Network - Expert Systems - Fuzzy Logic - Natural Language Processing - Deep Learning etc. iii. List Application Areas of AI - Robotics - E-Commerce - Navigation - Human Resource - Healthcare - Agriculture - Gaming - Automobiles - Social Media - Marketing, etc.

TOPICS/CONTENTS/NOTES	**OBJECTIVES**

4. Fundamentals of Robotics (a) Definition of Robotics (b) Main Components of Robotics (c) Types of Robots (d) Application Areas of Robotics (e) Advantages and Disadvantages of Robots	Candidates should be able to: i. Define Robotics ii. Define Robots iii. Identify main components of Robots - Control system - Sensors - Actuators - Power Supply - End Effectors etc. iv. Mention types of Robots - Humanoid Robots - Autonomous Robots - Teleoperated Robots - Augmenting Robots etc. v. Itemise application areas of Robots - Logistics - Manufacturing - Home - Travel - Healthcare - Security - Space exploration - Entertainment - Agriculture - Food Preparation - Manufacturing - Military - Customer Service etc. vi. State advantages and disadvantages of using Robots

SECTION I: Computer Ethics and Human Issues

TOPICS/CONTENTS/NOTES	OBJECTIVES
1. Ethical issues a. Computer–related crime b. Responsibility for computer failure c. Protection of computer property, records and software d. Privacy of the company, workers and customers.	Candidates should be able to: i. Define computer-related crime. ii. State examples of computer-related crime. (Compromising computer systems, hacking, theft, etc.) iii. List methods to prevent unauthorised use of computer system (user identification, Passwords etc.) iv. List methods to protect computer resources using both electronic and manual methods.

TOPICS/CONTENTS/NOTES	OBJECTIVES
Computer Security **2. Cyber risks and protection** **3.**	v. List methods to Protect privacy of individuals (workers, companies, customers, government etc.) by law and electronically. vi. Define computer security vii. Identify different types of computer security and their characteristics. - Network security - Internet security (cyber) - Application Security - Data security - Information security - End user security etc. viii. Identify appropriate security tool to use for the different types of computer security (Firewalls, antivirus software, encryption, etc.) ix. Identify categories of application threats and their characteristics (Input, authorisation, session management, parameter tampering, x. Identify basic dimensions of Information Security (Confidentiality, Integrity, and Availability (CIA)) xi. Mention Network security Issues (unauthorised, intrusion, rules and configurations that protect confidentiality, integrity and accessibility using both software and hardware.) xii. Mention Network security methods (antivirus software, application security, behavioural analytics, data loss prevention, email security, firewalls, mobile device security, network segmentation, security and event management (SEIM), Virtual Private Network (VPN), Web security, wireless security, Network Access Control (NAC). xiii. List Types of cyber security threats (Cybercrime, cyber-attack, cyber terrorism, malware, virus, trojans, spyware, Ransomware, Adware, Botnets, SQL injection, Phishing, Man-in-the-middle attack, Denial of Service, Dridex, Romance scams, Emotet malware, xiv. List Cyber security safety tips - Regular update of software and operating systems - Use of anti-virus software - Use of strong passwords - Do not open email attachments from unknown senders - Do not click on links in emails from unknown senders or unfamiliar websites, avoid use of unsecure WIFI networks in public places etc.

TOPICS/CONTENTS/NOTES	**OBJECTIVES**

4. Potentials for Higher Studies in Computing	Candidates should be able to: i. List possible career paths in computing - Software Developer - Software Test Engineer - Programme Analyst - System Developer - Web Developer - Software Development Engineer, - Computer System Analyst - Database Administrator - System Administrator - System Engineer - System Analyst - Network Engineer - Business Analyst - Program Manager - IT Specialist - Data Analyst/Scientist - AI and Robotics - System Security Analyst - Digital Forensic Analyst - Mobile App Developer - ICT Manager - Blogger - E- Marketer - Social Media Manager - ICT Educator - Career in Academia - Private Entrepreneurship - Internet Police - IT User Support/Desk Officer - ICT Librarian - Computer Instructor, etc.