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INSPECTION DE PEDAGOGIE CHARGEE DE L'ENSEIGNEMENT DE L'INFORMATIQUE

REPUBLIC OF CAMEROON
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MINISTRY OF SECONDARY EDUCATION

INSPECTORATE GENERAL OF EDUCATION

INSPECTORATE OF PEDAGOGY IN CHARGE OF THE TEACHING OF COMPUTER SCIENCE

Teaching Syllabus and Course Specifications
On
Information and Communication Technology
For General Education High Schools

Observe the environnements and choose better study options for a fulfilled life

LOWER SIXTH FORMS

July 2019

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INTRODUCTION

Information and Communication Technology (ICT), also known as Information Technology (IT), is the driving force in technological development. Its role in boosting economies of nations, industrial productivity, socio-cultural integration, development of professions, education and research, medicine, politics, communication, private households, and entertainment etc., has been enormous and popularized. There is therefore the need, to guide the Cameroonian youth into developing competencies in this domain thereby providing solutions to real life challenges. Such competencies developed at this level, are to build a solid framework for students who will continue with this domain of study, or other related disciplines, at the University level, those who will start their professional activities after High School, and those who just require digital literacy for solving their commonly encountered personal problems.

This syllabus is designed to mould candidates into acquiring or developing a range of IT skills in the context of a sound understanding of the technical foundation of current computer systems and to promote the knowledge and use of a wide range of current computer applications, particularly from the point of view of their design and implementation. It highlights issues related to societal implications of the use of ICTs. It extends to the design of simple software and basic digital circuits, thus equipping the learner with preliminary skills in computer technology and Computer Science. The emphasis is on fundamental principles that underlie ICTs rather than on the current state of the art, so that the knowledge acquired remains relevant even after significant technological evolution. A well-trained ICT student is expected to be able to make informed decisions on when and where to use ICT, and should also be aware of the implications of the use of ICTs in the home, at the job site, and in society at large.

Furthermore, even though this syllabus is oriented towards standard syllabuses used for computing and information technology at the advanced or equivalent levels and comparable to similar curricula across the world, it focuses more on development of competencies rather than just acquisition of knowledge.

In this context, the **Competency Based Approach** method of teaching/learning which favors learner centered teaching/learning has been adopted with an entry and/or exit through real life situations. Two main approaches have been used:

A. ***The Problem Based Learning Approach,*** in which the student /learner are presented with ill-structured real life problems and they play the role of active problem solvers, while the teacher assumes the role of a coach.
B. ***The Project Approach*** which is constructivist pedagogy. This involves the presentation of a real life situation in the form of a mini project; thereby provoking inquiry based learning and computational thinking, in which large problems are broken down into small tasks. These help foster students' life- long learning.

SECOND CYCLE LEARNER PROFILE

The learner profile of the second cycle of secondary school is summarized in the following components:

1. Demonstrate understanding and choice of career paths that lead to IT and computer-focused employment including computer management, programming, IT services, and systems development.
2. Exhibit proof of a thoroughly trained citizenry and a better equipped workforce for an information society or an emergent knowledge society.
3. Acquire and show essential preparedness for, or exemptions from requirements in, higher-level studies in ICT and related disciplines; and
4. Understand and apply pre-requisite knowledge for, and exemptions from, computing-related requirements in vocational and tertiary educational programmes.

AIMS OF THE SYLLABUS

The aims of this syllabus are:

1. To enhance development of skills and provide a foundation for advanced competencies in the following:
   a. Information processing.
   b. Information and Communications Technology.
   c. Computer programming.
2. To explore the impact of computers on people both as individuals in society and as integral parts of an organization and make contributions towards positive impact.

MODULES AND EXPECTED COMPETENCIES

The ICT syllabus is split up into 5 modules, which are carefully structured to take the learner from the introduction of the system through to the practical applications or using of it. The methodology for bringing this through is crafted with the proposal of mini projects at the end of most real life situations. The projects enable the learner to demonstrate competency after the acquisition and use of required skills for such competency. The modules are as follows:

CLASS	MODULES
LOWER SIXTH	**Module 1**: Computing Environment and Components
	Module II: Impacting society with digital technology
	Module III: Building ICT systems
UPPER SIXTH	**Module IV:** Communication and resource sharing in IT
	Module V: Practical problem solving in the digital world

Reasons for the structuring into five modules

The successful acquisition and use of a computing or ICT system generally may go through five stages which have been coined here, into modules. The paradigm behind the development of the five modules is as follows:

- Understanding what a computing environment looks like and how it works
- Identifying what it can be used for and how its existence affects the user and the environment

- Building the computing environment and configuring it to solve various problems
- Linking or interconnecting multiple computing environments for the purpose of sharing resources
- Solving real life problems using the already built computer

A successful navigation through the five modules adequately prepares the learner to demonstrate competencies in solving most real life situations that can be handled with the use of ICTs. Thus, the first three (03) modules are taught in Lower Sixth and the last two (02) in Upper Sixth.

Module 1: Computing Environment and Components (76 Hours)

This module introduces learners to what a computing environment looks like, and prepares them to demonstrate competency in identifying, selecting and installing preferable hardware and software components of a computer system, while implementing solutions to problems encountered in the course of working with them.

Competencies here are demonstrated in the following real life situations:

- Monitoring the evolution of computers over time and progressive advantages(revision)
- Description of a computer architecture
- Choosing a computer based on task to be performed
- Configuration of the computer system to process tasks for itself and for the user
- Configuring OS for various tasks
- Using language translators
- Configuration of working environment for different categories of users
- Troubleshooting, maintaining hardware/software
- Managing files and storing information using appropriate file formats
- Setting up the working environment such as to reduce/avoid health related hazards.
- Choosing category of computers for use, based on the quality of their products and services

Module 2: Impacting society with digital technology (80 Hours)

This module leads the learner into finding out the positive and negative changes the use of computers have brought or will bring into society, while proposing instruments for promoting its positive use and preventing negative use. It also looks at how computers and IS can be used to solve daily problems that need IT solutions. Learners here are prepared to demonstrate competency in using some common IS, identifying and proposing digital solutions to a variety of real life problems, and also to cause positive change in society through the use of ICTs while preventing negative change.

Competencies here are demonstrated in the following real life situations:

- Using information systems in an organization
- Proposing digital solutions to variety of real life problems
- Creating awareness of the social, legal, ethical and economic implications of using computers
- Discouraging the negative use of computers, while upholding positive use.
- Prevention of malware and their impact.
- Exploring and working with artificial intelligence
- Using simulation systems
- Discovering multimodal systems

- Using multimedia authoring tools
- Using virtual reality for education and entertainment
- Using Augmented reality for improved visual display, education, entertainment

Module 3: Building ICT systems (116 Hours)

This module introduces learners into how some hardware and software components of an IS are built, and enables them to demonstrate competency in designing IS, writing programs to solve some common problems, coupling of electronic circuits and implementation of these systems.

Competencies here are demonstrated in the following real life situations:

- Building information systems using standard models
- Modeling data in an IS
- Testing a developed information system
- Making choices on which storage device to use based on their capacity.
- Choosing processors based on their speed
- Analysis with digital arithmetic
- Initiation to digital circuits
- Choosing appropriate data types for representation and organization of information
- Designing software
- Selecting and working with programming paradigms
- Implementing programming language components
- Ensuring the built program works as expected
- Organized planning, running and evaluation of a project

The modules are further broken down into three main headings and eight sub- headings as follows:

I. **CONTEXTUALISATION:** This gives a global picture of the life situation from which lesson inspirations are drawn. This is further broken down into:

A) **Family of Real life situation**: This presents an umbrella statement that groups related real life situations

B) **Examples of Real life situations:** This column better situates the lesson by bringing practical examples of life situations

II. **COMPETENCES TO BE ATTAINED:** Competences refer to the ability to do something successfully and efficiently. The competences to be attained here refer to the abilities the learner is expected to build in the course of the lesson. This is subdivided into:

A) Categories of Actions: These group the examples of related actions learners are expected to be able to carry out in the course of the lesson.

B) Examples of Actions: These refer to the actions or activities the learner is expected to carry out successfully and efficiently as indicators of having built specific abilities in the course of the lesson.

III. **RESOURCES**: This refers to the necessary tools required to ensure a successful lesson. This is further broken down into:

A) Basic knowledge: The information and skills acquired, summarized into keywords that can facilitate research.

B) Attitudes: These are the behavioral changes expected to be employed by the learner during and/or after learning

C) **Other Resources:** These are material resources and equipment required to facilitate teaching/learning

D) **Duration:** This is the expected time interval during which teaching/learning is supposed to take place.

The following Table represents a summary of the teaching hours as well as the coefficient of ICT in the Lower Sixth Class.

CLASS	WEEKLY TEACHING LOAD (PERIODS)	WEEKLY PRACTICAL LOAD (PERIODS)	ANNUAL TEACHING LOAD (PERIODS)	COEFFI CIENTS
LOWER SIXTH	08	02	272	05

TEACHING AND LEARNING STRATEGY

Given the broad nature of skills and competencies that are expected to be developed or exhibited with the CBA approach, it becomes sometimes cumbersome and time consuming to bring the whole set of facilities required to ensure the proper execution of this approach, into the classroom setting. In order to curb this shortcoming, the teacher is required to use ICT tools in the teaching process, which will reduce maximize class time and enhance learner apprehension and comprehension. These tools often provide a better way of making abstract concepts real to the learner while arousing learner interest in what is taught, and also causing an internal motivation which will enable the learner explore and exploit his or her skills to the maximum of their interest.

These ICT tools may include projectors, multimedia resources such as video tutorials, applications, online resources, etc.

The teacher is also required to end every lesson or at least a group of lessons with assignments that consist of mini-projects that provide the opportunity for learners to develop their skills in problem solving.

The teacher also should provide opportunity for the learners to give their own opinion or what they think about the lesson that is taught. This could result in the exhibition of new knowledge and skills, which the teacher is then required to encourage the learner in developing such skills into competencies. As already previewed in the CBA, the dispensation of knowledge is learner cantered and not teacher cantered. Until a learner has acquired or developed skill in some particular area, that area is not considered taught.

Assessment and Evaluation

For this subject, it is recommended that continuous assessment be used and grades, instead of marks, awarded.

The seven-point scale that follows provides a record of the learning skills demonstrated by the learner in every module of the course through independent work, teamwork, organization, work habits, and initiative.

Remark	Honour Roll	Excellent	Good	Satisfactory	Needs improvement	Failed	Ungraded
% Score	90 and above	80 to 89	70 to 79	60 to 69	50 to 59	40 to 49	< 40
Grade	A	B	C	D	E	F	U

Table of main components of Module 1: Computing Environment

CONTEXTUALISATION		COMPETENCIES TO BE ATTAINED		RESOURCES			
Family of life situations	**Examples of life situations**	**Categories of actions (Topics)**	**Examples of actions (Skills)**	**Basic (core) knowledge**	**Attitudes**	**Didactic material**	**Duration**
Exploring the computing environment	Evolution of computers	1.1 Exploring generations and types of computers	▪ Identifying generations of computers ▪ Describing the main technology that characterized each generation ▪ Choosing computers based on tasks (home, banks, mass media services, government agencies, industries, etc.) ▪ Proposing computers for general and specific purposes	▪ Vacuum Tubes ▪ Transistors ▪ Integrated circuits ▪ Artificial intelligence ▪ Mainframe, minicomputer, Super computers microcomputer, arid, parallel and distributed computing.	Team spirit Honesty and diligence Communicative Creative Ethical reasoning Prudence Self-discipline Passion for technology	Computer laboratory Online resources (Photographs and videos of computer types)	4
	▪ Exploring computer components	1.2 Describing computer architectures	▪ Classifying peripherals ▪ Describing the Von Neumann architecture. ▪ Explaining stored program concept ▪ Identifying and using different types of readers and recognition systems ▪ Establishing the characteristics and performance of peripherals ▪ Describing processor configuration and components NB: detailed technical	▪ Input, output, processing devices. ▪ Main memory ▪ MICR, OCR, QR code, OMR, Bar code Reader etc. ▪ CPU ▪ Types of ROM ▪ Types of RAM ▪ ALU, CU, Registers, data bus, CD, DVD, CD-R,	Team spirit Honest and diligence Communicative Strong problem solving skills Critical thinking Ethical Systemic reasoning Self-discipline Attention to details Great communication skills Passion for technology	Sample hardware devices Digital resources Photographs and videos of computer types) Links: YouTube Computer laboratory, CPU, RAM, data flowchart among components	10

Exploring the Computing environment			knowledge of processor hardware is not expected. ▪ Identifying the roles of memory systems ▪ Distinguishing between SIMM and DIMM ▪ Describing a storage hierarchy based on size and speed ▪ Establishing the differences between categories of storage devices ▪ Differentiating between primary and secondary storage devices ▪ Upgrading memory and storage of computers in the lab.	DVD-R, CD-RW, DVD-RW ▪ Optical, solid state and magnetic storage devices	Honesty and diligence Communicative Strong problem solving skills Critical thinking Ethical Logical reasoning Systemic reasoning Prudence Self-discipline Attention to details Great communication skills Passion for technology	Sample optical storage devices, magnetic storage devices, solid state storage devices Digital resources(Photographs and videos of above devices) Links: YouTube Google	
		1.3 Functioning of the processor	▪ Distinguishing between the processor architectures ▪ Establishing the advantages of each processor architecture. ▪ Selecting machine for use based on processor ▪ Explaining the machine cycle. ▪ Contrasting Polling and interrupts; detection of interrupts.	▪ RISC, CISC, SISD, SISD, SISD and MIMD ▪ Fetch-decode-execute-store ▪ Polling and interrupts ▪		**Didactic materia**l CPU	7
Exploring the Computing environment	▪ Transferring data between software packages ▪ Installing packages for various purposes ▪ Determining software to use based on its full	1.4 Classification of software	▪ Establishing differences between system software and application software ▪ Establishing differences between custom made and general purpose software types	system software: Application software Bespoke, off-the-shelf		**Didactic material** Computer lab, Sample software in a computer system or phone installation discs, formatted computers or **Digital resources**(e.g. Pictures or video	3
			▪ Installing and configuring OS ▪ Selecting and Installing application packages for	▪ OS ▪ utility software ▪ Drivers			5

	functionality and the right to access and manipulate the source code.		handling different user tasks	▪ applications		showing software interfaces) **Links:** YouTube Google	
			▪ Distinguishing between demo ware, shareware and freeware with examples of their functionalities. ▪ Establishing with examples, the difference between open source and closed source software.	▪ Demo ware, shareware and freeware ▪ Open source and closed source software			4
Exploring the Computing environment	▪ Determining OS types ▪ Functioning of Operating Systems ▪ Selecting OS interfaces ▪ Describe Job scheduling strategies in OS ▪ Analyzing the concept of processor sharing ▪ Executing commands using the command line ▪ Selecting OS for use on networked or standalone computers ▪ Configuring OS for networks,	1.5 Configuring Operating Systems (OS)	▪ Identifying OS types and their evolution	▪ -Single user, ▪ -Batch ▪ -On-line, ▪ -multiuser, ▪ -NOS, multitasking, real-time transaction processing, network and process control OS	Honesty and diligence Communicative Strong problem solving skills A desire to automate Logical reasoning Systemic reasoning Self-discipline Attention to details Passion for technology	Computer lab, Samples of OS Digital **resources**(e.g. Pictures or video showing device management by OS) Links: YouTube Google	7
			▪ Determining the functions of OS	▪ -process management ▪ -Memory management ▪ -device management ▪ -file management			
			▪ Identifying OS interfaces ▪ Exploring strengths and weaknesses of each ▪ Selecting the desired interface for use	GUI, CLI, WIMP			
			▪ Distinguishing between pre-emptive and non-pre-emptive scheduling strategies ▪ Describing scheduling algorithms	*First Come First Served, Shortest Job First, Round Robin and Shortest Remaining Time Next*		computers Digital resources(e.g. Pictures or video showing job scheduling in OS) Links: YouTube	5
			▪ Explaining the concept of	▪ Multitasking			

Exploring the Computing environment	security		processor sharing	▪ Multiprogramming		Google	
			▪ Identifying some command line environments ▪ Using commands to create and manage files and folders ▪ Using commands to configure networks ▪ Formatting a storage device using command line ▪ Creating a batch file	▪ MS-DOS, LINUX etc.	Team spirit Strong problem solving skills Thirst for knowledge A desire to automate Critical thinking Creative Ethical Logical reasoning Systemic reasoning Prudence Self-discipline Passion for technology	Computer lab, CLI minimum of 2 types of OS, Projector, modem, ISP, Hot spot, **Digital resources**(e.g. Pictures or video showing command executions, OS configuration) **Links:** YouTube Google	5
			▪ Identifying the properties of some stand-alone and server OS ▪ Determining OS to use.	▪ Windows , Windows server, Linux, Linux server			5
			▪ Setting up OS to connect to a wired or wireless network. ▪ Setting up OS to avoid unauthorized access into system.	▪ OS, Networks, security			
	Demonstrating ability to use language translators	1.6 Using language translators	▪ Explaining the importance of language translators ▪ Describing the different language translators: ▪ Demonstrating ability to use IDE of compilers and interpreters ▪ Carrying out lexical analysis, syntax analysis, code generation procedure calling and parameter passing.	▪ High level and low level programming languages ▪ Assemblers, compilers and interpreters Mobile app development (e.g. MIT App Inventor).		IDEs for Compilers and Interpreters Digital resources(e.g. Pictures or video showing IDE interfaces) **Links:** YouTube Google	5
Exploring the Computing environment	▪ Selecting hardware/software for different category of users ▪ Storing video, text, audio,	1.7 Configuring user environment and managing files	▪ Identifying different category of computer users and their disabilities ▪ Proposing hardware / software that aid them to work with the computer system ▪ Identifying commonly used file	▪ Blind, maimed etc. braille keyboard and audio devices, ASR ▪ File systems Binary; Graphic(i.e. bit-mapped, and	Team spirit Honesty and diligence Accountability Communicative Strong problem solving skills A desire to automate	Braille machine, ASR Systems etc. Digital resources(e.g. Pictures or video showing categories of computer users)	8

Exploring the Computing environment	multimedia etc. ▪ Using appropriate file formats for each. ▪ Determining applications for opening different file formats ▪ Storing and organizing files in hierarchy ▪ Compressing and decompressing files ▪ Selecting different file systems for storage		formats and what objects they are used in storing ▪ Attaching applications used for handling the above files ▪ Opening a folder with different types of files and listing their file extensions. ▪ Finding applications to open them. ▪ Explaining notions of file organization ▪ Displaying storage hierarchy and file paths ▪ Selecting file compression software ▪ Installing compression software ▪ Explaining file compression methods ▪ Calculating the file compression ratio ▪ Identifying different file systems ▪ Establishing their comparative advantages ▪ Compressing a file of at least 5MB and determine its compression ratio.	Vector); Sound; Video; Document transmission; Common application file formats; Hypermedia ▪ Record, table, file, folder, drive ▪ WinZip, WinRAR ▪ lossy compression lossless compression ▪ FAT, NTFS	Critical thinking Creative Ethical Logical reasoning Systemic reasoning Self-discipline Passion for technology Team spirit Honesty and diligence Accountability Communicative Strong problem solving skills A desire to automate Critical thinking Creative Ethical Logical reasoning Systemic reasoning Prudence Self-discipline Passion for technology	Software for editing video, pictures, sound etc. Links: YouTube Google Files in a computer system, projector Sample archive software Digital resources(e.g. pictures and videos of different file compression methods) Storage device	

Explore the Computing environment	Detecting common problems with hardware and software	1.8 Troubleshooting and maintaining hardware and software	▪ Identifying faults in computer system due to hardware or software failure or malfunction ▪ Proposing solutions to curb these failures Implementing solutions	▪ blue screen, screen flickering, disk cleanup system restore		Computers that need maintenance Digital resources(e.g. videos of troubleshooting methods)	5
	Designing the workplace environment to reduce health related hazards	1.9 Setting up the working environment such as to reduce/avoid health related hazards.	▪ Pointing out wrong posture and wrong equipment positioning at the work place ▪ Stating the corresponding health related hazards for the above ▪ Illustrating right posture and right equipment positioning to avoid corresponding health related hazards	▪ Ergonomics		**Digital resources** (e.g. pictures and videos on rightful posture and equipment positioning)	5
	▪ Researching on information system vendors and their products ▪ Acquiring hardware/software	1.10 Choosing category of computers for use, based on the quality of their products and services	▪ Identifying companies and their products. ▪ Establishing comparative advantages and disadvantages of their products and services ▪ Identifying manufacturers of computing products, computer dealers and distributors ▪ Identifying manufacturers of software packages.	Leasing, timesharing and network providing companies. mainframe and special purpose computers, PC, OS, Hardware and Applications		**Digital resources**(e.g. pictures and videos of computer equipment and their manufacturers)	3

Table of Main components of Module 2: Impact of digital technology on the society

CONTEXTUALISATION		COMPETENCIES TO BE ATTAINED		RESOURCES			
Family of life situations	**Examples of life situations**	**Categories of actions (Topics)**	**Examples of actions (Skills/Lessons)**	**Basic (core) knowledge**	**Attitudes**	**Didactic material**	**Duration**
Determining the range and scope of computer applications	Identifying natural and artificial systems	2.1.1 Describing a system	▪ Defining a system ▪ Distinguishing between types of systems ▪ Drawing data flow diagrams ▪ Representing system diagrams		Team spirit Honesty and diligence Accountability Strong problem solving skills A desire to automate Critical thinking Creative Ethical Logical reasoning Systemic reasoning Prudence Self-discipline Passion for technology	Computers , projector Digital resources(e.g. pictures and videos of) Links: YouTube Google	2
	▪ Assembling the necessary components to realize an information system ▪ Determining the information system type to	2.1.2 Using information systems in an organization	▪ Defining an information system ▪ Declaring the roles of: ▪ People, Procedures, Technology , Data in IS	*database* administrators, *network administrators, software engineers, stock control, satellite*			6
			Explaining the functioning of IS types in an organization	Administrative information		Computers , projector Digital	

CONTEXTUALISATION		COMPETENCIES TO BE ATTAINED		RESOURCES			
Family of life situations	**Examples of life situations**	**Categories of actions (Topics)**	**Examples of actions (Skills/Lessons)**	**Basic (core) knowledge**	**Attitudes**	**Didactic material**	**Duration**
Determining the range and scope of computer applications	be used at different levels of an organization. ▪ Describing information flow within an organization.		Stating the factors affecting each of their existence	system, EIS, GIS, HIS, Library information system (LIS). MIS, DSS	Team spirit Honesty and diligence Accountability Communicative Algorithmic thinking Strong problem solving skills A desire to automate Critical thinking Creative Ethical Logical reasoning Systemic reasoning Prudence Self-discipline Passion for technology	resources(e.g. pictures and videos of IS types)	
			Establishing the category of workers concerned and the issues addressed in an IS for each level of the organization Identifying factors affecting the success/failure of an IS	Managers in IS; information workers in knowledge work systems, TPS		Computers , projector Links: YouTube Google	
	▪ Determining hardware and software for use in different methods of communication ▪ Identifying general and commercial data processing systems ▪ Identifying systems for solving industrial, technical and scientific problems ▪ Setting up	2.1.3 Proposing digital solutions	▪ Identifying manual systems and their limitations in communication ▪ Identifying existing digital replacements of such manual systems	Phones, Tablet, computers		Digital resources (pictures and videos of manual and digital communication devices)	3
			▪ Stating examples of general and commercial data processing systems ▪ Explaining how each system functions ▪ Proposing existing application packages that can be tailored to help in data processing (e.g. spread sheets, etc.) ▪ Visiting institutions and making appraisals of their IS	School management software, banking software, hospital administration, personnel records system, stock control and order processing		Samples of software for banking, hospital management etc. Digital resources(e.g. pictures and videos of the operation of above systems)	3
			▪ Explaining and giving examples of industrial, technical and scientific uses of computer systems.	Weather forecasting, CAD and CAM, image	Team spirit Honesty and diligence	**Didactic** Sample software for weather forecasting, CAD	3

CONTEXTUALISATION		COMPETENCIES TO BE ATTAINED		RESOURCES			
Family of life situations	**Examples of life situations**	**Categories of actions (Topics)**	**Examples of actions (Skills/Lessons)**	**Basic (core) knowledge**	**Attitudes**	**Didactic material**	**Duration**
Determining the range and scope of computer applications	automation, control systems, monitoring systems embedded systems and running robots for different tasks. ▪ Managing arts and media projects with the computer		▪ Explaining how such systems function ▪ Visiting institutions using systems for general and specific purposes	processing, industrial inspection systems, simulation and modeling	Accountability Communicative Algorithmic thinking Strong problem solving skills A desire to automate Critical thinking Creative Ethical Prudence Self-discipline Passion for technology Team spirit	Digital resources(videos of the operation of above systems)	
			▪ Stating examples of automation, control systems, monitoring systems, embedded systems and robotic systems ▪ Installing and configuring a control system ▪ Installing and configuring a monitoring system ▪ Explaining how they function	Patient monitoring systems, chemical process control, traffic control, domestic equipment, automatic navigation systems and industrial robots		a monitoring system, control system Digital resources(e.g. pictures and videos of the operation of automation, monitoring, control systems) Links: YouTube Google	7

CONTEXTUALISATION		COMPETENCIES TO BE ATTAINED		RESOURCES			
Family of life situations	**Examples of life situations**	**Categories of actions (Topics)**	**Examples of actions (Skills/Lessons)**	**Basic (core) knowledge**	**Attitudes**	**Didactic material**	**Duration**
Determining the range and scope of computer applications			▪ Identifying areas of computer applications in the arts and media ▪ Creating and mix beats, rhythm, using a music production software ▪ Producing and edit photographs using graphic design software ▪ Producing and edit motion pictures(or movies) using animation software Design a magazine, using publication software	music, graphic design and animation for television and film, production of newspapers	Honesty and diligence Accountability Communicative Algorithmic thinking Strong problem solving skills A desire to automate Creative Ethical Prudence Self-discipline Passion for technology	Different software for running video works, music production, etc. Digital resources(e.g. pictures and videos tutorials)	9
Analyzing Change of attitudes, consequences and methods of containment with using ICTs.	▪ Creating positive social and economic effects. ▪ Educate on positive use of Computers ▪ Implementing system security and reliability measures ▪ Preventing	2.2.1 Creating awareness of the social, legal, ethical and economic implications of using computers	▪ Explaining effects of computers on people and organizations ▪ Stating positive and negative uses of computer systems	Social effects Economic effects Legal implications Ethics	Team spirit Honesty and diligence Accountability Communicative Algorithmic thinking Strong problem solving skills A desire to automate	Short sample documentaries on how computers are used in each area cited Links: YouTube Google	5
			▪ Explaining security, reliability and resilience of systems and consequences of system failure. ▪ Describing data handling ▪ Measuring to protect computer systems from illegal access and use	▪ Data handling ▪ Measures ▪ ▪ backup, use of passwords,		Computer, backup devices, projector Digital resources(e.g. pictures and video tutorials on implementing	5

CONTEXTUALISATION		COMPETENCIES TO BE ATTAINED		RESOURCES			
Family of life situations	**Examples of life situations**	**Categories of actions (Topics)**	**Examples of actions (Skills/Lessons)**	**Basic (core) knowledge**	**Attitudes**	**Didactic material**	**Duration**
Analyzing Change of attitudes, consequences and methods of containment, with using ICTs.	computer crimes ▪ Creating awareness on professional, ethical, legal and moral obligations of users ▪ Using ICTs to improve global communication and culture		▪ Stating the importance of recovery in the event of system failure ▪ Explaining the importance of privacy, and safe working practices	encryption, physical security	Critical thinking Creative Ethical Prudence Self-discipline Passion for technology	security measures)	
			▪ Identifying types of computer crimes and giving examples ▪ Explaining with examples, measures to combat computer crime	▪ computer assisted crime and computer related crime physical security, security codes, encryption, biometrics		Computer, projector	3
			▪ Identifying and explaining legislation, code of ethics and moral obligation of users, in existence.	▪ BCS, IEEE or ACM ▪ Cyber legislation in Cameroon		Print outs or screen display of professional codes of conduct and laws with respect to the use of ICTs	3
			▪ Determining the effects of global communication on the concept of citizenship, cultural issues and digital divide. ▪ Explaining how ICTs can be responsibly used to influence communication and cultures.	▪ Effects of ICTs on communication ▪ Effects of ICTs on citizenship and cultures ▪ The digital divide	Team spirit Honesty and diligence Accountability Communicative Algorithmic thinking Strong problem solving	Short movies on how underdeveloped countries became developed through ICTs projector **Links** Google YouTube	3

CONTEXTUALISATION		COMPETENCIES TO BE ATTAINED		RESOURCES			
Family of life situations	**Examples of life situations**	**Categories of actions (Topics)**	**Examples of actions (Skills/Lessons)**	**Basic (core) knowledge**	**Attitudes**	**Didactic material**	**Duration**
Analyzing Change of attitudes, consequences and methods of containment with using ICTs.	▪ Exploring the actions of different types of malware ▪ Implementing prevention and elimination methods	2.2.2 Preventing malware and their impacts	▪ Identifying different types of malware ▪ Installing and scanning computer system with antivirus ▪ Installing and configuring firewalls to block untrusted websites and unauthorized access	▪ Malware ▪ Antivirus ▪ Firewalls	skills A desire to automate Critical thinking Creative Ethical Prudence Self-discipline Passion for technology	Antivirus samples Digital resources(e.g. pictures and videos tutorials on prevention methods)	5
Artificial intelligence (AI) and simulation	▪ Applying AI to improve on working and living conditions ▪ Using robots for personal, business and industrial purposes	2.3.1 Exploring and working with artificial intelligence	▪ Explaining what AI is ▪ Establishing difference between human brain and computers ▪ Exploring areas of application of AI	▪ Artificial intelligence ▪ Neural networks, Genetic algorithms, Expert systems, Fuzzy logic, Patten recognition, Natural language analysis, robots, CYC and COG	Team spirit Honesty and diligence Accountability Communicative Algorithmic thinking Strong problem solving skills A desire to automate Critical thinking Creative Ethical Prudence	Digital resources (e.g. videos on applications of AI)	5
			▪ Describing a robot ▪ Identifying different spheres of life in	▪ Robotics ▪ Packet tracer		Digital resources e.g. videos on how to build robots	3

CONTEXTUALISATION		COMPETENCIES TO BE ATTAINED		RESOURCES			
Family of life situations	**Examples of life situations**	**Categories of actions (Topics)**	**Examples of actions (Skills/Lessons)**	**Basic (core) knowledge**	**Attitudes**	**Didactic material**	**Duration**
			which robots are used ▪ Outlining advantages and limitations of using robots		Self-discipline Passion for technology		
Using Simulation and Multimodal systems	▪ Representing real life situations in a computer system ▪ Demonstrate the use of multimedia systems for presentation and entertainment	2.4.1 Using simulation and multimedia authoring tools	▪ Explaining simulation ▪ Outlining advantages and limitations of simulation. ▪ Using ICT tools to simulate events around your environment ▪ Representing simulations in computer systems	▪ Games ▪ Videos ▪ Paper tracing ▪ Packet tracer		Digital resources(e.g. videos on how simulations are built)	3
			▪ Identifying and using some multimedia platforms ▪ Explaining how multimedia systems work ▪ Outlining advantages	▪ VLC player, Windows Media player Smart boards		Multimedia display platforms	3
	Identifying multimodal systems	2.4.2 Discovering multimodal systems	▪ Describing multimodal systems ▪ Giving examples of multimodal systems	▪ Multimedia, Augmented reality[AR], Virtual reality[VR])			3
Using Simulation and Multimodal systems	▪ Demonstrating use of VR in education, entertainment, business and industry	2.4.3 Using Virtual Reality (VR) and Augmented Reality (AR)	▪ Identifying components of a VR system ▪ Explaining how VR works ▪ Outlining roles of VR in different areas of life	▪ Head mounted display, VRML Games, education		Digital resources (e.g. videos on how VR works) Link Google YouTube	3

CONTEXTUALISATION		COMPETENCIES TO BE ATTAINED		RESOURCES			
Family of life situations	**Examples of life situations**	**Categories of actions (Topics)**	**Examples of actions (Skills/Lessons)**	**Basic (core) knowledge**	**Attitudes**	**Didactic material**	**Duration**
	▪ Demonstrating use of AR in education, entertainment and other areas of life		▪ Identifying components of an AR system ▪ Explaining how AR Works ▪ Outlining the role of AR in different areas of life ▪ Playing a game that uses AR or VR.	▪ flat panel display games, education		Digital resources (e.g. videos on how AR works) Link Google YouTube	3

Table of Main components of Module 3: Building ICT Systems

CONTEXTUALISATION		COMPETENCIES TO BE ATTAINED		RESOURCES			
Family of life situations	**Examples of life situations**	**Categories of actions (Topics)**	**Examples of actions (Skills)**	**Basic (core) knowledge**	**Attitudes**	**Didactic material**	**Duration**
Developing Information systems	▪ Applying software development life cycle strategies : ✓ Constructing IS using step-by-step procedure ✓ Prototyping approach for system development.	3.3.1 Building information systems using standard models	▪ Identifying stages in the SDLC ▪ Describing and comparing different system development models. ▪ Identifying and explaining the steps in prototyping	▪ The System Development Life Cycle ▪ Waterfall model of SDLC, Prototyping, Boehm's spiral model ▪ Prototyping	Team spirit Honesty and diligence Accountability Communicative Algorithmic thinking A desire to automate Creative Logical reasoning Systemic reasoning Passion for technology	Charts on different models. Link Google YouTube Charts of the various models.	8

CONTEXTUALISATION		COMPETENCIES TO BE ATTAINED		RESOURCES			
Family of life situations	**Examples of life situations**	**Categories of actions (Topics)**	**Examples of actions (Skills)**	**Basic (core) knowledge**	**Attitudes**	**Didactic material**	**Duration**
Developing Information systems	▪ Distinguishing between old and modern methods of data modeling ▪ Reinforcing ER modeling ▪ Implementing data capture in an IS	3.3.2 Modeling data in an IS	▪ Comparing and contrasting between flat file processing and database approach ▪ Explaining Data modelling ▪ Describing various levels of data modeling	▪ Conceptual, logical, physical modeling ▪ Entity relationship(ER) model, ▪ Unified Modeling Language (UML) model ▪ Relational model and Object	Team spirit Honesty and diligence Accountability Communicative Algorithmic thinking Strong problem solving skills A desire to automate Critical thinking Creative Ethical Logical reasoning Systemic reasoning Prudence Self-discipline Passion for technology	RDBMS application Projector . Digital resources(e.g. pictures and videos tutorials on data modeling approaches)	7
			▪ Establishing entity relationship models in an IS	▪ Entity ▪ Attributes ▪ Key attributes			3
			▪ Applying the relational model ▪	▪ Relational database management systems(RDBS) ▪ Redundancy ▪ Normalization up to 3NF		Database application	3
			▪ Explaining data capture, and its types ▪ Explaining data verification and validation	▪ Automatic and manual data capture ▪ Verification and validation		Didactic material data capture devices, computer lab0 Digital resources(e.g. pictures and videos tutorials)	7
	Employing various testing regimes	3.3.3 Testing a developed information system	▪ Implementing the procedure for module testing ▪ Establishing the importance of testing	▪ Unit testing ▪ Integration testing ▪ System testing ▪ Acceptance testing	Testing Integrity	Digital resources (e.g. videos on testing methods)	5

CONTEXTUALISATION		COMPETENCIES TO BE ATTAINED		RESOURCES			
Family of life situations	**Examples of life situations**	**Categories of actions (Topics)**	**Examples of actions (Skills)**	**Basic (core) knowledge**	**Attitudes**	**Didactic material**	**Duration**
Representing information and organizing data in a computer system	▪ Applying the units for measuring storage capacity in a computer system ▪ Applying the units of measuring ▪ speed and time in a computer system	3.4.1 Choosing storage devices based on capacity 3.4.2 Choosing processors based on speed	▪ Exploring units of storage ▪ Converting from one unit to another: ▪ Exploring the units of time ▪ Exploring the units of speed	▪ Storage ▪ (bits, bytes, kilobytes, etc.) KB=1000B(everyday) vs. 1024B (technical) ▪ Time ▪ Picoseconds (ps), nanoseconds (ns), microseconds (µs), milliseconds (ms), seconds (s) ▪ Speed (Hz, MHz and GHz)	Team spirit Honesty and diligence Accountability Communicative Algorithmic thinking Strong problem solving skills A desire to automate Critical thinking Creative Ethical Logical reasoning Systemic reasoning Prudence Self-discipline Passion for technology	Sample storage devices Sample processors(or CPUs) Digital resources(e.g. pictures and videos tutorials) Link Google YouTube	5
Basic Understanding and building of integrated circuits	▪ Converting from one number base to another	3.5.1 Working with digital arithmetic	▪ Identifying number systems ▪ Converting from base 2 to base 8, 10 and 16 and vice versa. ▪ Computing arithmetic operations	▪ Binary arithmetic ▪ Sign magnitude representation ▪ One's complement ▪ Two's complement		Computer, projector Digital resources(e.g. pictures and videos tutorials) Link Google YouTube	5
	▪ Applying Boolean logic ▪ Designing logic circuits	3.5.2 Exploring digital circuits	▪ Identifying and sketching different types of logic gates ▪ Deriving truth tables from Boolean expressions(up to 3 input variables) ▪ Deriving Boolean expressions from truth tables ▪ Simplifying Boolean expressions	▪ Boolean Algebra ▪ Logic gates : ✓ OR ✓ AND ✓ NOT ✓ NAND ✓ NOR ✓ XOR ✓ XNOR		Electronic kits Digital resources (e.g. picture and video tutorials on logic gates)	7

CONTEXTUALISATION		COMPETENCIES TO BE ATTAINED		RESOURCES			
Family of life situations	**Examples of life situations**	**Categories of actions (Topics)**	**Examples of actions (Skills)**	**Basic (core) knowledge**	**Attitudes**	**Didactic material**	**Duration**
			▪ Applying De Morgan's theorem.				

CONTEXTUALISATION		COMPETENCIES TO BE ATTAINED				RESOURCES	
Family of life situations	**Examples of life situations**	**Categories of actions (Topics)**	**Examples of actions (Skills)**	**Basic (core) knowledge**	**Attitudes**	**Didactic material**	**Duration**
Developing software	▪ Choosing appropriate data types for representation and organization of information	3.6.1 Representing and Organizing information	▪ Identifying standard data types ▪ Representing complex data types	▪ Standard data types(e.g. real , Boolean, character, integers) ▪ Complex data types(e.g. arrays, strings, records, lists)			5

CONTEXTUALISATION		COMPETENCIES TO BE ATTAINED				RESOURCES	
Family of life situations	**Examples of life situations**	**Categories of actions (Topics)**	**Examples of actions (Skills)**	**Basic (core) knowledge**	**Attitudes**	**Didactic material**	**Duration**
Developing software	▪ Using software design methodologies to solve problems ▪ Developing algorithms ▪ ▪ Testing and evaluating algorithms ▪ Explaining programming paradigms	3.6.2 Designing software	▪ Demonstrating an understanding of structured design ▪ Applying structured design methodology ▪ Explaining uses of unit and structuring diagrams ▪ Sequencing instructions ▪ Using textual descriptions ▪ Explaining algorithms ▪ Characterising algorithms ▪ Representing algorithms: ▪ Using flowcharts ▪ Using pseudocodes ▪ Implementing basic algorithmic constructs ▪ Analyzing algorithms ▪ Understanding recursion ▪ Applying sorting and searching techniques ▪ Performing dry run	▪ Top-down design ▪ Stepwise refinement ▪ Incremental construction ▪ Divide-and-conquer ▪ Bottom-up design ▪ Adapting existing solutions ▪ Modular design ▪ Structured diagrams ▪ Algorithm ▪ Efficiency ▪ sequence, selection ▪ while, for, and with-statements ▪ basic notions of time and space complexity, ▪ Bubble, merge, and insertion sorts etc. ▪ binary and sequential searches ▪ dry run		Digital resources (e.g. video demonstrations of design strategies) Computer Projector IDE, Charts, projector Digital resources(e.g. pictures and videos tutorials) Link Google YouTube	21
			▪ Establishing correctness of algorithms ▪ Assessing reasonableness of solutions and relative correctness.	▪ Evaluation Algorithms		IDE, computer projector . **Digital resources**(e.g. pictures and videos tutorials)	5

CONTEXTUALISATION		COMPETENCIES TO BE ATTAINED				RESOURCES	
Family of life situations	**Examples of life situations**	**Categories of actions (Topics)**	**Examples of actions (Skills)**	**Basic (core) knowledge**	**Attitudes**	**Didactic material**	**Duration**
Developing software			▪ Defining Programming paradigm ▪ Distinguishing between different types of programming paradigms ▪ Establishing the relative advantages and disadvantages of each paradigm.	▪ Imperative, ▪ Declarative, ▪ Functional ▪ Logic, ▪ procedural, ▪ Object-oriented		Charts, projector . **Digital resources**(e.g. pictures and videos tutorials) **Link** Google YouTube	3
	▪ Applying software reuse ▪ Determining when to use internally or externally developed software ▪ Demonstrating use of language translators	3.6.3 Selecting and working with programming paradigms	▪ Explaining the need for the reuse of existing software ▪ Identifying criteria for selecting software for reuse ▪ Elaborating on the purpose of library units, repositories.	▪ Software reuse ▪ Library units ▪ Repositories ▪ Software Packaging		Program code in course of development, computer lab . **Digital resources**(e.g. pictures and videos tutorials)	5
			▪ Differentiating between internal and external developed software ▪ Selecting software for reuse based on relative advantages and disadvantages	▪ Internally developed and externally developed software		**Digital resources**(e.g. pictures and videos tutorials) **Link** Google YouTube	5
			▪ Demonstrating the ability to use compilers, interpreters, lexical analysis, code generation	▪ Using language translators		Sample language translators Digital resources(e.g. pictures and videos tutorials)	5

CONTEXTUALISATION		COMPETENCIES TO BE ATTAINED				RESOURCES	
Family of life situations	**Examples of life situations**	**Categories of actions (Topics)**	**Examples of actions (Skills)**	**Basic (core) knowledge**	**Attitudes**	**Didactic material**	**Duration**
Developing software	▪ Converting data structures and algorithms to programs ▪ Using features of high level languages	3.6.4 Implementing programming language components	▪ Demonstrating knowledge of mapping data structures and algorithm to the programming language constructs ▪ Understanding and using programming language syntaxes and semantics ▪ Using procedural abstraction, self-documenting identifiers and code, standard program units	▪ Data structures ▪ Constructs ▪ Syntax ▪ semantics		IDE, projector Digital resources(e.g. pictures and videos tutorials on programming) Link Google YouTube	9
			▪ Demonstrating knowledge of the use of: ✓ Data constructs ✓ I/O operations ✓ Control constructs, ✓ Procedural abstraction ✓ Parameter passing by reference and by value. ▪ Defining and using data structures and values ▪ Demonstrating knowledge of stack mechanism for procedure calling and parameter passing	▪ Data types, data structures, Data values, variables, constants, locations, scoping) ▪ I/O operations ▪ Procedures and functions ▪ Local and global variables ▪ File handling operations ▪ Program clarity ▪ Program Efficiency ▪ Program Reliability		IDE. , computer laboratory Digital resources(e.g. pictures and video tutorials on programming procedures and parameter passing) Link Google YouTube	5

CONTEXTUALISATION		COMPETENCIES TO BE ATTAINED				RESOURCES	
Family of life situations	**Examples of life situations**	**Categories of actions (Topics)**	**Examples of actions (Skills)**	**Basic (core) knowledge**	**Attitudes**	**Didactic material**	**Duration**
	▪ Testing developed programs	3.6.5 Working with written programs	▪ Using simple debugging techniques ▪ Demonstrating testing strategies	▪ Debugging software ▪ Boundary data, ▪ Correct data and erroneous data program tracing debug code		IDE, Computer lab Digital resources (e.g. videos on testing strategies)	3