

NATIONAL COUNCIL FOR
CURRICULUM & ASSESSMENT
(MINISTRY OF EDUCATION)



COMPUTING
COMMON CORE PROGRAMME (CCP)
CURRICULUM FOR JHS1 (B7) - JHS3 (B9)

SEPTEMBER, 2020



MINISTRY OF EDUCATION
REPUBLIC OF GHANA

LEVEL OF PROFICIENCY	BENCHMARK	GRADE LEVEL DESCRIPTOR
1: Highly proficient (HP)	80% +	Learner shows high level of proficiency in knowledge, skills and values and can transfer them automatically and flexibly through authentic performance tasks.
2: Proficient (P)	68-79%	Learner demonstrates sufficient level of proficient knowledge, skills and core understanding; can transfer them independently through authentic performance tasks
3: Approaching Proficiency (AP)	54-67%	Learner is approaching proficiency in terms of knowledge, skills and values with little guidance and can transfer understanding through authentic performance tasks
4: Developing (D)	40-53%	Learner demonstrates developing level of knowledge, skills and values but needs help throughout the performance of authentic tasks
5: Emerging (E)	39% and below	Learner is emerging with minimal understanding in terms of knowledge, skills, and values but needs a lot of help.

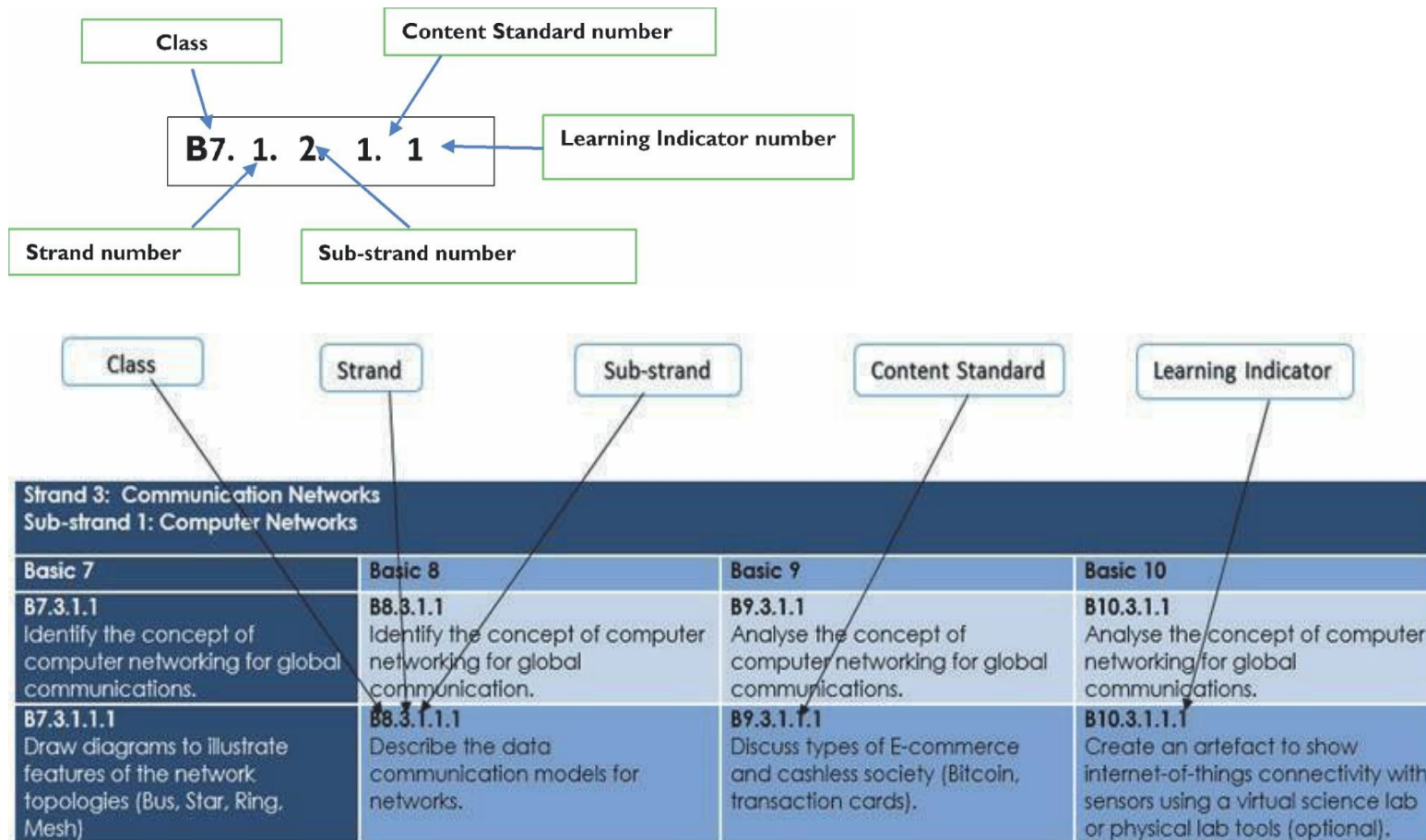
The grading system presented, shows the letter grade system and equivalent grade boundaries. In assigning grades to learners' test results, or any form of evaluation, the above grade boundaries and the descriptors may be applied. The descriptors (Highly Proficient [HP], Proficient [P], Approaching Proficiency [AP], Developing [D], Emerging [E] indicate the meaning of each grade. In addition to the school-based assessment (SBA), a national standards assessment test is conducted in Basic 8 to provide national level indicators on learners' achievement

SCOPE AND SEQUENCE

Strand	Sub-strand	B7	B8	B9
Introduction to Computing	Components of Computers and Computer Systems	✓	✓	✓
	Technology in The Community	✓	✓	✓
	Health and Safety in the use of ICT Tools	✓	✓	✓
Productivity Software	Introduction to Word Processing	✓	✓	✓
	Introduction to Presentation	✓	✓	✓
	Introduction to Desktop Publishing		✓	✓
	Introduction to Electronic Spreadsheet	✓	✓	✓
Communication Networks	Computer Networks	✓	✓	✓
	Internet and Social Media	✓	✓	✓
	Information Security	✓	✓	✓
	Web Technologies	✓	✓	✓
Computational Thinking	Introduction to Programming	✓	✓	✓
	Algorithm	✓	✓	✓
	Robotics	✓	✓	✓
	Artificial Intelligence	✓	✓	✓

Curriculum Reference Numbers

A unique annotation used for numbering the strands, sub-strands, content standards and indicators in the curriculum for the purpose of easyreferencing is shown below:



BASIC 7

STRAND I: INTRODUCTION TO COMPUTING
SUB-STRAND I: COMPONENTS OF COMPUTERS AND COMPUTER SYSTEMS

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B7.1.1.1. Examine the parts of a computer	B7.1.1.1.1 Discuss the fourth-generation computersExemplar(s): 1. Discuss features of fourth generation computers 2. Identify a microchip 3. Explore the architecture of a processor	Creativity and Innovation (CI), Communication and Collaboration (CC), Digital Literacy (DL),Critical thinking and Problem solving (CP). Cultural Identity and Global Citizenship, Personal Development and Leadership (PL))
	B7.1.1.1.2 Demonstrate understanding in the use of input devices(barcode, scanner, etc.) Exemplar(s): 1. Watch video or picture of input devices e.g. wireless keyboard, mouse and touchscreen in class 2. Demonstrate the use of input devices in a computer laboratory/classroom. 3. Distinguish manual (e.g. keyboard, etc.) and automatic (e.g. barcode readeretc.) input devices. 4 Explore the advantages and disadvantages of input devices 5. Explore areas where different types of input devices are used..	. CI6.1: Exhibit strong memory, intuitive thinking, and respond appropriately CC7.4: Identify underlying themes, implications and issues when listening.

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
	<p>B7.1.1.1.3. Examine the uses of the output devices: graphing plotter, data and multimedia projectors as well as pico projector</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Watch video or pictures of output devices in use. 2. Demonstrate the use of output devices in a computer laboratory/classroom. 3. Explore the advantages and disadvantages of output devices. 	<p>CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.</p> <p>DL5.3: Ability to find and utilise digital content</p>
	<p>B7.1.1.1.4 Examine full-sized external hard drives, hard drive speed, disk caching, Storage portable hard drives, Optical Discs and Drives.</p> <p>Exemplar(s):</p> <p>E. g. Read-Only Optical Discs: CD-ROM, DVD-ROM, and BD-ROM Discs Recordable Optical Discs: CD-R, DVD-R, DVD+R and BD-R Discs Rewritable Optical Discs: CD-RW, DVD-RW, DVD+RW and BD-RE Discs</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Identify magnetic storage devices, portable hard drives/Optical Discs and Drives or pictures of these items to class. 2. Discuss the features of hard drives/Optical Disc storage media. 3. Explore the maximum capacities of these storage devices. 4. Explore the different write speeds of these storage devices. 5. Explore the differences in the various Hard Disk Drives (HDD). 	<p>CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.</p> <p>DL5.3: Ability to find and utilise digital content.</p>

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B7.1.1.2. Demonstrate the use of the features of the Windows Desktop	B7.1.1.2.1 Discover the latest Windows Operating System (Start screen, Use of tiles, Taskbar buttons, Preview thumbnails), temporal peeking into a window on a taskbar Exemplar(s): <ol style="list-style-type: none"> 1. Show the desktop, tiles, taskbar. 2. Demonstrate how to preview thumbnails 3. Explore the features of the taskbar. 4. Demonstrate how to preview windows on the taskbar. 	CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.
	B7.1.1.2.2 Practise file management techniques (file & folder management, Users & Accounts) <ol style="list-style-type: none"> 1. Explore different account levels for users of computer systems. 2. Explore different permission levels that are applied to files and folders. Exemplar(s): <ol style="list-style-type: none"> 1. Demonstrate file management techniques by following the naming conventions and organising files in folders and subfolders 2. Explore the types and importance of file extensions. 3. Explore different account levels for users of computer systems 4. Explore different permission levels that are applied to files and folders. 	CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group. CI6.9: Interpret and apply learning in new contexts.

STRAND 1: INTRODUCTION TO COMPUTING

SUB-STRAND 2: TECHNOLOGY IN THE COMMUNITY

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
<p>B7.1.2.1. Demonstrate the use of Technology in the community.</p>	<p>B7.1.2.1.1. Describe and give examples of at least five technology tools for learning in each subject (e.g. Spreadsheets, Virtual Museum, Scrabble, Presentation, Scratch, etc.)</p> <p>Exemplar(s):</p> <p>I. Explore the various technology tools that can be used for learning.</p> <p>NB: Exploration can be done through learners surfing the internet or the teacher guiding them to brainstorm the ICT tools.</p>	<p>DL5.3: Ability to find and utilise digital content.</p> <p>CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.</p>
	<p>B7.1.2.1.2. Demonstrate the use of at least three technology tools identified in B7.1.2.1.1.</p> <p>Exemplar(s):</p> <p>I. Demonstrate the use of a technology tool in groups and present to the whole class how that tool works.</p>	<p>CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.</p> <p>DL5.3: Ability to find and utilise digital content</p>
	<p>B7.1.2.1.3. Discuss the benefits of using technology tools in learning.</p> <p>Exemplar(s):</p> <p>I. Discuss in pairs the benefits of using technology tools in learning (e.g. using spreadsheet to draw graphs)</p>	<p>CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.</p> <p>DL5.3: Ability to find and utilise digital content.</p>

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
	<p>B7.1.2.1.4. Examine the negative impact of computers and computer use on the environment</p> <p>Exemplar(s): Observe people who use and work with computers in the community.</p> <p>2. Visit websites or watch videos/pictures of how computers, including other electronic components, are disposed of.</p> <p>Discuss the impact of computers and computer use on the environment.</p>	
	<p>B7.1.2.1.5. Propose environmentally responsible practices that can be used to reduce the negative impact of computers and computer use on the environment</p> <p>Exemplar(s): Discuss how the negative effects identified can be reduced.</p> <p>Evaluate environmentally responsible practices.</p> <p>3. Propose measures to effectively manage e-waste in a particular environment (e.g. Agbogbloshie).</p>	
	<p>B7.1.2.1.6. Create a component from disposed computer parts.</p> <p>Exemplar(s): Collect disposed computer/electronic parts from the community.</p> <p>Watch a video/picture depicting the recycling of computer parts.</p>	

STRAND 1: INTRODUCTION TO COMPUTING
SUB-STRAND 3: HEALTH AND SAFETY IN THE USE OF ICT TOOLS

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
<p>B7.1.3.1. Demonstrate how to apply Health and Safety measures in using ICT Tools</p>	<p>B7.1.3.1.1 Describe health measures and current regulatory requirements and potential computing-related disorders Exemplar(s):</p> <ol style="list-style-type: none"> 1. Watch videos on the health hazards of prolonged use of computing devices or show pictures of bad body postures and other hazards in using computing devices e.g. hearing impairment from loud Public Address (PA) Systems, vision impairment from the monitor, repetitive strain injury, Carpal tunnel syndrome, computer vision syndrome, etc. 2. Identify the health hazards associated with each device. 3. Provide preventive measures regarding the stated health and safety risks. <p>B7.1.3.1.2 Describe Safety measures in using ICT tools Exemplar(s):</p> <ol style="list-style-type: none"> 1. Discuss the danger of spilling liquids on a computer device or on the electronic circuit. 2. Discuss tripping over power cables and touching the negative and positive terminals of electrical wires. 	<p>CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.</p> <p>DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.</p> <p>DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem</p>
	<p>B7.1.3.1.3 Demonstrate how to apply Health and Safety measures in Using ICT Tools</p> <p>B8.1.3.1.1 Examine workstation health risk assessment methods Exemplar(s):</p> <ol style="list-style-type: none"> 1. Explore the risks associated with workstations and how to overcome them (e.g. wrist pains, eye problems, back and neck pains, faulty electrical connections, etc.) 	<p>PL5.3: Recognise one's emotional state and their preparedness to apply emotional intelligence.</p> <p>CP 5.7: Provide new insight into controversial situation or task</p>
	<p>B7.1.3.1.4 Explore safety measures at workstations Exemplar(s):</p> <ol style="list-style-type: none"> 1. Identify measures that will help to eliminate workstation hazards and where they cannot be eliminated, discuss how to minimise the risk. (e.g. evaluating display screen, adjusting the chair for comfort, avoiding potential slips and falls, re-positioning of devices, etc.) 	<p>PL5.3: Recognise one's emotional state and their preparedness to apply emotional intelligence</p> <p>CP 5.7: Provide new insight into controversial situation or task</p>

STRAND 2: PRODUCTIVITY SOFTWARE
SUB-STRAND 1: INTRODUCTION TO WORD PROCESSING

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B7.2.1.1 Demonstrate how to use Microsoft Word (Editing)	B7.2.1.1.1. Explain the importance of word processing software Exemplar(s): <ol style="list-style-type: none"> 1. Discuss the meaning of word processors. 2. Brainstorm to elicit the importance of word processors 3. Brainstorm to elicit examples of some common word processing software packages (e.g. MS-Word, Corel WordPerfect, AbiWord, Google Docs, LibreOffice Writer, Notepad, WordPad, etc.) 	CC8.2: Explain ideas in a clear order with relevant detail, using correct construction and structure of speech. DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
	B7.2.1.1.2. Demonstrate how to insert, select, delete and move text Exemplar(s): <ol style="list-style-type: none"> 1. Show projected examples of MS-Word interface with the aid of a computer, projector or pictures. 2. Explore tools for editing in MS Word 3. Explore the use of the overtyping or insert option by right-clicking the statusbar. 	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
	B7.2.1.1.3. Demonstrate how to find and replace content and undo edited changes Exemplar(s): <ol style="list-style-type: none"> 1. Make use of the Find and Replace tool in MS-Word under the Home tab 2. Explore the use of the Editing group under the Home tab 	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B7.2.1.1 Demonstrate how to use Microsoft Word (Editing)	B7.2.1.1.4. Demonstrate how to spell check, carry out content translation, language setting Exemplar(s): <ol style="list-style-type: none"> 1. Demonstrate the use of the Proofing and Language group under the Review tab 2. Show how to use the Language, Spelling & Grammar, Thesaurus and other tools in MS-Word under the Home tab. <p>NB: This is to help learners gain software knowledge in office applications (word processing) to grasp the concept better.</p>	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
	B7.2.1.1.4.5 Demonstrate how to use text-decoration, change text case, text size and colour Exemplar(s): <ol style="list-style-type: none"> 1. Explore the use of the Font group under the Home tab 2. Demonstrate the use of sentence case, font size, colour and font decoration features in MS-Word 3. Project examples of MS-Word interface to learners with the aid of a projector or pictures. 	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem. CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges
	B7.2.1.1.4.6 Demonstrate how to align text, indent paragraphs, bullet, line space and shade Exemplar(s): <ol style="list-style-type: none"> 1. Explore the use of the Paragraph group, using the align left, centre, align right and justified in MS-Word under the Home tab. 2. Explore the use of Bullets, Decrease and Increase Indentation under the Home tab. 3. Identify the use of the Border Button and set line spacing using the dialogue Box Launcher button under the Home tab. 	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem. CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges

<p>B7.2.1.1 Demonstrate how to use Microsoft Word(Formatting Text)</p>	<p>B7.2.1.1.3. Demonstrate how to set tabs and apply formatting</p> <p>Exemplar(s):</p> <p>I. Explore the Tab button to set the centre and right tabs</p> <p>NB: This is to help learners with software knowledge in office applications (word processing) to grasp the concept better.</p>	<p>DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem</p> <p>CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges</p>
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STRAND 2: PRODUCTIVITY SOFTWARE

SUB-STRAND 2: INTRODUCTION TO PRESENTATION SOFTWARE

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B7.2.2.1 Demonstrate how to use Microsoft PowerPoint (Editing): Introduction to PowerPoint.	B7.2.2.1.1. Explain the importance of presentation software Exemplar(s): <ol style="list-style-type: none"> 1. Discuss the meaning of presentation software. 2. Discuss the benefits of using presentation software. 3. Brainstorm to elicit the names of some common presentation software packages (e.g. MS-PowerPoint, Corel Presentation, Adobe persuasion, Google Slides, Keynotes etc.) 	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem
	B7.2.2.1.2. Explore features of MS-PowerPoint interface. Exemplar(s): <ol style="list-style-type: none"> 1. Show examples of MS-PowerPoint interface with the aid of a projector or pictures. 2. Explore MS-PowerPoint themes and templates 3. Explore the use of the Proofing and Language group under the Review tab 4. Demonstrate the use of the Language, Spelling & Grammar, Thesaurus and other buttons in MS-PowerPoint under the Review tab 	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
	B7.2.2.1.3. Demonstrate how to use Special Characters. Design a 7-slide presentation in MS-PowerPoint using the tools under the Insert ribbon. Exemplar(s): <ol style="list-style-type: none"> 1. Explore the use of special characters section under the Insert tab under the symbol group 2. Present a prepared project or exercise using the editing group of the ribbons studied. 3. Use projected examples of a PowerPoint interface with the aid of a projector or pictures 4. Use projected examples of a PowerPoint interface with the aid of a projector or pictures. 	CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges. CC9.6: Ability to work with all group members to complete a task successfully

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
<p>B7.2.2.2 Demonstrate how to use Microsoft PowerPoint (Formatting)</p>	<p>B7.2.2.2.1. Demonstrate how to change text case, text size, text colour and decorate text</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Explore the use of the Font group under the <i>Home</i> ribbon. 2. Make use of the sentence case, font size, colour and font decoration features in MS-PowerPoint 3. Project examples of PowerPoint interface to learners with the aid of a projector or pictures. 	<p>DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.</p> <p>CI5.4: Ability to visualise alternatives, see possibilities, and identify problems and challenges.</p>
	<p>B7.2.2.1.2. Demonstrate how to align text, indent paragraphs, borders and shades.</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Explore the use of the Proofing and Language Sections under the Review ribbon. 2. Use the Language, Spelling & Grammar, Thesaurus and other buttons in MS-PowerPoint under the Review ribbon. 	<p>DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.</p> <p>CI5.4: Ability to visualise alternatives, see possibilities, and identify problems and challenges.</p>
	<p>B7.2.2.1.3. Demonstrate the use of the Slide Master, design template, and be able to give a 5-slide presentation in MS-PowerPoint using the tools of the ribbons studied.</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Explore the use of Master Views group under the View ribbon 2. Prepare and present a prepared project or exercise using what has been studied in Indicator 1 and 2. <p>NB: This is to help the learners with software knowledge in MS-PowerPoint, Office Applications to grasp the concept well.</p>	<p>DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem</p> <p>CI5.4: Ability to visualise alternatives, see possibilities, and identify problems and challenges.</p>

STRAND 2: PRODUCTIVITY SOFTWARE
SUB-STRAND 3: INTRODUCTION TO ELECTRONIC SPREADSHEET

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B7.2.3.1. Demonstrate how to use the Spreadsheet (Editing Worksheets)	B7.2.3.1.1. Explain the importance of electronic spreadsheet Exemplar(s): <ol style="list-style-type: none"> 1. Discuss the meaning of electronic spreadsheet. 2. Discuss the benefits of using electronic spreadsheet software. 3. Brainstorm to elicit response some common electronic spreadsheet software packages (e.g. MS Excel, Lotus 1-2-3, LibreOffice Calc, GoogleSheets etc.) 	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
	B7.2.3.1.2. Explore features of MS-Excel interface Exemplar(s): <ol style="list-style-type: none"> 1. Show projected examples of MS-Excel interface with the aid of a projector or pictures. 2. Explore operations of inserting, selecting, deleting and moving data. 3. Demonstrate how to insert, select, delete and move data using a sample data set. 	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
	B7.2.3.1.3. Demonstrate how to set the cell datatype (General, Number, Currency, etc.). Exemplar(s): <ol style="list-style-type: none"> 1. Investigate how to set and modify the cell type of values and text. 2. Enter values, text, dates and time in worksheet cells and change the formats for presentation. E.g. General, Number, Currency, Accounting, Dates, Time, etc. 	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.

	<p>B7.2.3.1.4. Demonstrate how to use Align Text, Merge & Wrap, Borders and Shades</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Demonstrate how to change text alignment (Horizontal & Vertical), merge cells and wrap text. 2. Investigate how to access border & shade features and format the appearance of a worksheet as group work. 	<p>DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.</p>
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CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B7.2.3.2. Demonstrate how to format a worksheet	B7.2.3.2.1 Demonstrate how to adjust margins and set page orientation Exemplar(s): <ol style="list-style-type: none"> 1. Demonstrate how to adjust margins and set page orientation for printing. 2. Perform margin adjustment on different page sizes 3. Explore the display of worksheets in different views as listed on the View tab. 	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem. CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges.
	B7.2.3.2.2. Demonstrate how to set up a header and a footer. Exemplar(s): <ol style="list-style-type: none"> 1. Demonstrate how to set up header and footer elements. 2. Explore the use of page numbers, current date, time and file name in setting up headers and footers. 	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem
	B7.2.3.2.3. Demonstrate the use of the Autofill function in MS-Excel worksheet Exemplar(s): <ol style="list-style-type: none"> 1. Demonstrate the use of the Autofill function e.g. to generate the days of the week, months of the year, set of numbers (e.g. counting numbers, odd numbers, multiplication tables etc.). 	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem
B7 2.3.3 Demonstrate how to use spreadsheet formula	B7.2.3.3.1. Demonstrate how to create formulas Exemplar(s): <ol style="list-style-type: none"> 1. Create simple formulas starting with the equal sign (=) 	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem. CP5.1: Ability to combine information and ideas from several sources to reach a conclusion

STRAND 3: COMMUNICATION NETWORKS

SUB-STRAND 1: COMPUTER NETWORKS

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B7.3.1.1 Identify the concept of computer networking for global communications	B7.3.1.1.1 Draw diagrams to illustrate features of the network topologies (Bus, Star, Ring, Mesh) Exemplar(s): <ol style="list-style-type: none"> 1. Explore key hardware for setting up network systems (such as server, client, hub, switch, cable, etc.). 2. Explain network topologies. 3. Discuss the features of each network topology. 4. Present in groups diagrams of well-elaborated network topologies. NB: Watch any appropriate video on the above 	CI6.1: Exhibit strong memory, intuitive thinking and respond appropriately. DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem
	B7.3.1.1.2 Describe types of networks [Personal Area Network (PAN), Local Area Network (LAN), Metropolitan Area Network (MAN), Wide Area Network (WAN)] Exemplar(s): <ol style="list-style-type: none"> 1. Explain the various types of networks available (e.g. PAN, LAN, MAN, WAN, WLAN, INTERNET, etc.). <ul style="list-style-type: none"> - A Metropolitan Area Network (MAN) connects local networks across a larger geographical region. 	CI6.6: Being open-minded, adapting and modifying ideas to achieve creative results. DL5.4: Ability to construct knowledge from a non-linear hyper textual navigation
	B7.3.1.1.3 Discuss the entrepreneurial opportunities in networking computing devices Exemplar(s): <ol style="list-style-type: none"> 1. Discuss the benefits and challenges of networking in different environments (school, business, health, etc.). 2. Identify different environments where the various types of networks can be applied Identify the business aspect of networking and how they can be turned into a lucrative business.	DL5.4: Ability to construct knowledge from a non-linear hyper textual navigation

STRAND 3: COMMUNICATION NETWORKS

SUB-STRAND 2: INTERNET AND SOCIAL MEDIA

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B7.3.2.1 Demonstrate the use of Social Networking and Electronic Mail	B7.3.2.1.1 Identify the various types and uses of Social Media sites such as those for Social Networking (Facebook, LinkedIn, WhatsApp) and Microblogging (Twitter, Tumblr) Exemplar(s): <ol style="list-style-type: none"> 1. Illustrate the use of social networking sites such as Facebook, LinkedIn, WhatsApp, etc. 2. Demonstrate the use of microblogging platforms such as Twitter, Tumblr, etc. 	CI 6.3: Ability to select the most effective creative tools for work, and give reasons for the choice DL6.3: Use digital tools to create novel things
	B7.3.2.1.2 Demonstrate the use of the following features of Electronic mail: Attachment and Address book Exemplar(s): <ol style="list-style-type: none"> 1. Demonstrate the steps in creating, sending and receiving email 2. Demonstrate replying to and forwarding email 3. Demonstrate, giving reasons for using From:, To: cc:, bcc: and subject features when sending an email. 	CI 6.3: Ability to select the most effective creative tools for work, and give reasons for the choice DL: Create and use digital content

STRAND 3: COMMUNICATION NETWORKS

SUB-STRAND 3: INFORMATION SECURITY

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
<p>B7.3.3.1. Recognise data threats and means of protection</p> <p>B7.3.3.1. Recognise data threats and means of protection</p>	<p>B7.3.3.1.1 Discuss the key principles of information security (confidentiality, integrity and availability)</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Research in pairs the key principles of information security. 2. Discuss the three key principles of information security. 3. Research scenarios involving information security 	<p>DL6.5: Recognition of societal issues emanating from the use of digital technologies</p> <p>CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.</p>
	<p>B7.3.3.1.2 Explore the legal issues regarding intellectual property rights (e.g. Copyright, Patent, Trademark, Piracy, Copyright Infringement)</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Discuss issues pertaining to copyright (e.g. freeware, shareware, crippleware). 2. Differentiate between the various legal issues mentioned. <p>Discuss the consequences associated with breaking these laws.</p>	<p>DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.</p> <p>CC8.4: Anticipate different responses from the participants and plan for them.</p>
	<p>B7.3.3.1.3 Evaluate information security forensic auditing and criminal laws against offenders</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Watch a video of how offenders of data security breach are identified. 2. Discuss the laws protecting data and the applicable sanctions for their breach. <p>Identify some common occurrences of data security breaches that people in the community overlook and their corresponding sanctions.</p>	<p>DL6.6: Knowledge and recognition of ethical use of information</p> <p>CC9.5: Appreciate importance of including all team members in discussions and actively encourage contributions from them</p>

STRAND 3: COMMUNICATION NETWORKS

SUB-STRAND 4: WEB TECHNOLOGIES

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B7.3.4.1. Demonstrate the use of a Web Browser (Search engine)	B7.3.4.1.1 Identify the importance of the web in learning [Virtual Learning Environments (VLEs)] Exemplar(s): 1. Explore the importance of VLEs for learning. <ul style="list-style-type: none"> • Allow self-paced learning (E-learning). • Create opportunity to learn new skills without having to use a regular classroom. 	CC6.1: Exhibit strong memory, intuitive thinking; and respond appropriately DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem
	B7.3.4.1.2 Explore the use of open learning websites in the classroom Exemplar(s): 1. Explore the uses of open learning websites in the classroom e.g. KhanAcademy, Coursera, Edx, Saylor, etc.	CI5.4: Ability to visualise alternatives, see possibilities, and identify problems and challenges. DL6.3: Use digital tools to create novel things.
	B7.3.4.1.3 Demonstrate the techniques for evaluating web pages (Accuracy, Credibility, Content, Current, Functionality) Exemplar(s): 1. Demonstrate the techniques for evaluating web pages. <ul style="list-style-type: none"> • Accuracy: How true is the information? • Credibility: Who wrote the page? Is the person an expert in the subject matter? • Content: Is it on the correct subject matter? • Current: Is the content up-to-date? When was the last time it was updated? Functionality: Does the site work well?	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem

STRAND 4: COMPUTATIONAL THINKING
SUB-STRAND 1: INTRODUCTION TO PROGRAMMING

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B7.4.1.1. Show an understanding of the concept of programming	B7.4.1.1.1 Demonstrate the correct use of programming terminologies Exemplar(s): <ol style="list-style-type: none"> 1. List the terminologies in alphabetical order or grouping to aid recall 2. Explain each of the terminologies 	CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group DL5.5: Evaluate the quality and validity of information
	B7.4.1.1.2 Demonstrate understanding in the use of data types (e.g. float, integer, string, char, etc.) Exemplar(s): <ol style="list-style-type: none"> 1. Develop key questions around daily activities to identify the data type. Example: The first name of your best friend is written as a string data type. 	CP5.1: Ability to combine information and ideas from several sources to reach a conclusion DL6.5: Recognition of societal issues emanating from the use of digital technologies
	B7.4.1.1.3 Demonstrate the use of constants and variables used in programming Exemplar(s): <ol style="list-style-type: none"> 1. Show how constants and variables are used in programming. 2. Discuss the benefits of using variables instead of constants. 	CC8.2: Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.

STRAND 4: COMPUTATIONAL THINKING

SUB-STRAND 2:ALGORITHM

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
<p>B7.4.2.1. Analyse the correct step-by-step procedure in solving any real-world problem</p>	<p>B7.4.2.1.1 Understand the use of sequence, selection and iteration in writing a programme. Describe the meanings of the term's algorithm, decomposition and abstraction</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Write numbers (1-10) in an orderly arrangement to represent sequence. Write your itinerary for a day in a logical order (Sequence). <p>NB: The above should be linear with no branching statements.</p> <ol style="list-style-type: none"> 2. Present a case study that has more than one option to choose from and still achieve the same outcome with any option chosen. For example, tea with or without sugar options can still meet a beverage outcome (selection). 2. Develop a solution to a problem which uses iteration to control the flow of the programme (iteration). <p>NB: Programs such as lightbot could be used for practical lessons.</p>	<p>CP6.1: Ability to effectively define goals towards solving a problem</p> <p>CC8.2: Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.</p>
	<p>B7.4.2.1.2 Perform a linear search</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Locate a given value position out of listed values. 2. Arrange some given values or data in increasing and decreasing order. 	<p>CP6.1: Ability to effectively define goals towards solving a problem.</p>

STRAND 4: COMPUTATIONAL THINKING

SUB-STRAND 3: ROBOTICS

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B7.4.3.1 Discuss Robot Intelligence Concepts	<p>B7.4.3.1.1 Review the various applications of robotic machines insociety Exemplar(s):</p> <ol style="list-style-type: none"> 1. State the applications and uses of robots in society (e.g. manufacturing, health, education, assembling and packing, transport, surgery, laboratory research, mass production of consumer and industrial goods, taking pictures,etc.) 2. Explore prospects and challenges of using robots in various operations 	<p>DL6.5: Recognition of societal issues emanating from the use of digital technologies</p> <p>CC8.2: Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.</p>

STRAND 4: COMPUTATIONAL THINKING

SUB-STRAND 4:ARTIFICIAL INTELLIGENCE

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B7.4.4.1. Discuss Artificial intelligence concepts	<p>B7.4.4.1.1 Discuss the application of various areas of artificial intelligence (Machine learning, Artificial Neural Networks, Virtual Reality,Augmented Reality, Mixed Reality, Gamification Exemplar(s):</p> <ol style="list-style-type: none"> 1. Compare the key technologies: machine learning, Artificial Neural Networks (ANN), Reality,Augmented reality, Gamification, Deep Learning,Artificial Data Mining and Analytics. (NB: general definitions only) 2. Discuss the uses and importance of Artificial Intelligence (AI) to society. 3. Watch video/picture of the use of AI in society (intelligent robots). 	<p>DL6.5: Recognition of societal issues emanating from the use of digital technologies</p> <p>CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group</p>

BASIC 8

STRAND I: INTRODUCTION TO COMPUTING
SUB-STRAND I: COMPONENTS OF COMPUTERS AND COMPUTER SYSTEMS

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B8.1.1.1. Identify parts a computer and technology tools	<p>B8.1.1.1.1. Discuss the fifth generation of computers with emphasis of on quantum computing</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Discuss the features of the fifth-generation computers. 2. Describe quantum computing using the Google operational quantum computing called “Sycamore”. <p>Discuss parallel processing hardware and Artificial Intelligence (AI) software.</p>	<p>Communication and Collaboration(CC), Digital Literacy (DL)</p> <p>CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group</p>
	<p>B8.1.1.1.2. Demonstrate understanding of direct data entry devices (Graphic Tablet, Magnetic Card Reader, Optical Card Reader, QR code reader, Radio Frequency Identification (RFID) Readers)</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Identify Graphic tablet, Magnetic card reader, optical card reader, QR code reader, Radio Frequency Identification (RFID) Readers from video or pictures. 2. Explore features of these input devices. 3. Explore how these input devices work in real life situations. 4. Generate QR codes and link them to specific websites. 	<p>DL5.3: Ability to find and utilise digital content.</p>

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B8.1.1.1. Identify parts of a computer and technology tools	B8.1.1.1.3. Examine the uses of the output devices: Braille printers, Impact, Inkjet, Thermal, Wax, 3D printers Exemplar(s): <ol style="list-style-type: none"> 1. Identify Braille printers, Impact, Inkjet, Thermal, Wax, 3D printers from pictures or videos. 2. Explore the features of these output devices. 3. Explore how these output devices work in real life situations. 	DL5.3: Ability to find and utilise digital content
	B8.1.1.1.4 Describe storage devices: Flash Memory Storage Systems, Embedded Flash Memory Cards and Readers, USB Flash Drives, Solid State Drives and Hybrid hard drives Exemplar(s): <ol style="list-style-type: none"> 1. Illustrate the use of Flash Memory Storage Systems, Embedded Flash Memory, Flash Memory Cards and Readers, USB Flash Drives, Solid State Drives and Hybrid hard drives. 2. Discuss the features of Flash Memory Storage Systems, Embedded Flash Memory Flash Memory Cards and Readers. 	CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group. DL5.3: Ability to find and utilise digital content
B8.1.1.2. Demonstrate the use of the Desktop features.	B8.1.1.2.1 Explore the use of the Charms bar Exemplar(s): <ol style="list-style-type: none"> 1. Identify the icons in the Charms bar 2. Describe features of the Charms bar icons 	DL5.3: Ability to find and utilise digital content
	B8.1.1.2.2. Practise file management techniques (Drive Management) Exemplar(s): <ol style="list-style-type: none"> 1. Demonstrate the file management techniques such as defragmentation, compression of files, etc. 2. Explore ways of partitioning a hard disk. 	DL5.3: Ability to find and utilise digital content

STRAND 1: INTRODUCTION TO COMPUTING
SUB-STRAND 2: TECHNOLOGY IN THE COMMUNITY

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B8.1.2.1. Demonstrate the use of Technology in the Community	B8.1.2.1.1. Discuss technologies that help to improve computer accessibility (adaptive and assistive technologies) Exemplar(s): <ol style="list-style-type: none"> 1. Identify the categories of people with special needs. 2. Discuss technologies that can be used to help people with special needs (e.g. Computer software and hardware such as voice recognition programs, screen readers, and screen enlargement applications, to help people with mobility and sensory impairments use computers and mobile devices, etc.) 	DL5.3: Ability to find and utilise digital content CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.
	B8.1.2.1.2. Describe how portable computing devices affect our everyday lives Exemplar(s): <ol style="list-style-type: none"> 1. Discuss portable computing devices that we use daily e.g. mobile phones, smart watches, etc. 2. Describe how these devices affect our daily lives. 	DL5.3: Ability to find and utilise digital content CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.
	B8.1.2.1.3. Explain the issues associated with online services (e.g. social media, wikis, blogs, etc.) Exemplar(s): <ol style="list-style-type: none"> 1. Identify the online services that learners normally use or have access to. 2. Evaluate issues that are associated with online service delivery. 	DL5.3: Ability to find and utilise digital content

STRAND 1: INTRODUCTION TO COMPUTING
SUB-STRAND 3: HEALTH AND SAFETY IN THE USE OF ICT TOOLS

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B8.1.3.1. Demonstrate How to Apply Health and Safety measures in Using ICT Tools	B8.1.3.1.1 Discuss health issues at workstations Exemplar (s): 1. Discuss the importance of taking regular breaks from bulk work (possibly after every hour). 2. Discuss the adoption of good posture while at the computer 3. Discuss the use of document holders to avoid having to lean over and bend your neck while looking at paperwork.	PL5.6: Ability to set and maintain personal standards and values. DL5.3: Ability to find and utilise digital content.
	B8.1.3.1.2 Discuss safety measures in risk reduction at workstations Exemplar (s): 1. Demonstrate the use of appropriate volumes when using speakers and earpieces. 2. Demonstrate the use of screen protectors/spectacles to control the amount of light received by our eyes. 3. Illustrate how not to overload electric sockets but use trailing multi-socket units rather than plug adapters.	PL5.6: Ability to set and maintain personal standards and values.

STRAND 2: PRODUCTIVITY SOFTWARE
SUB-STRAND 1: INTRODUCTION TO WORD PROCESSING

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S):	CORE COMPETENCIES
<p>B8.2.1.1 Demonstrate How to Use Microsoft Word (tables and hyperlink pages)</p>	<p>B982.1.1.1. Demonstrate how to create a table and hyperlinks Exemplar(s):</p> <ol style="list-style-type: none"> 1. Explore the use of the Tables group under the Insert tab 2. Create tables, columns and resize them in MS-Word 3. Explore the use of hyperlinks to create non-linear presentations. 	<p>CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges. DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.</p>
	<p>B8.2.1.1.2. Demonstrate how to merge, split, add formula, borders and shades Exemplar(s):</p> <ol style="list-style-type: none"> 1. Explore merging, splitting, adding formulas, borders and shades in MS-Word under the Insert tab. 2. Explore the use of the bullets; decrease and increase indentation under the Home tab. 3. Explore the use of the Border Button and set line spacing (e.g. explore the use of the dialogue Box Launcher button under the Home tab) 	<p>DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.</p>
	<p>B8.2.1.1.3. Demonstrate how to format a page (e.g. page adjustment, inserting header and footer, page numbers, breaks and orientations) Exemplar(s):</p> <ol style="list-style-type: none"> 1. Demonstrate how to format pages by adjusting the header, footer, page numbers, and page orientation <p>NB. This is to help the learners with software knowledge in office applications (word processing) to grasp the concept better.</p>	<p>DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.</p>

STRAND 2: PRODUCTIVITY SOFTWARE
SUB-STRAND 2: INTRODUCTION TO PRESENTATION

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B8.2.2.1 Demonstrate how to use Microsoft PowerPoint (Multimedia)	B8.2.2.1.1. Demonstrate how to add pictures, screenshot and edit and format pictures Exemplar(s): <ol style="list-style-type: none"> 1. Explore the use of the Images Group under the Insert tab 2. Demonstrate the use of ClipArt, Photo Album and Screenshot 3. Project examples of the PowerPoint interface to learners with the aid of a projector or pictures. 	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem. CC9.6: Ability to work with all group members to complete a task successfully.
	B8.2.2.1.2. Demonstrate how to add a drawing canvas, shapes, and also edit, format and add text to shapes Exemplar(s): <ol style="list-style-type: none"> 1. Explore the use of the Illustrations group under the Insert tab 2. Illustrate the use of Shapes and SmartArt 3. Explore the use of the drawing canvas to group shapes. 	CI5.4: Ability to visualise alternatives, see possibilities, and identify problems and challenges. DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
B8.2.2.1 Demonstrate how to use Microsoft PowerPoint (Multimedia)	B8.2.2.1.3. Demonstrate how to add text to shapes and arrange shapes. Exemplar(s): <ol style="list-style-type: none"> 1. Explore the use of the Format Ribbon once a shape is selected 2. Explore the editing features of the Insert Shapes and Shape Styles. 3. Present a prepared project or exercise using what has been studied in Indicator 1 and 2. <p>NB: This is to help the learners with software knowledge in MS PowerPoint, Office Applications to grasp the concept well.</p>	CC9.6: Ability to work with all group members to complete a task successfully DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.

STRAND 2: PRODUCTIVITY SOFTWARE

SUB-STRAND 3: INTRODUCTION TO DESKTOP PUBLISHING

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B8.2.3.1. Demonstrate how to use MS-Publisher	B8.2.3.1.1. Explain the importance of desktop publishing software (DTP) Exemplar(s): <ol style="list-style-type: none"> 1. Discuss the meaning of desktop publishing software. 2. Brainstorm to elicit the importance of DTP. 3. Brainstorm to elicit responses of some DTP packages. (e.g. MS-Publisher, Adobe InDesign, LibreOffice Draw, QuarkXpress etc.) 	CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges. DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
	B8.2.3.1.2 Create and save a new document from a blank or pre-designed template Exemplar(s): <ol style="list-style-type: none"> 1. Open a desktop publishing software (e.g. MS-Publisher). 2. Create a new document from a blank publication 3. Create a new document from a pre-designed template. 4. Save the document with the appropriate name. 	CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem
B8.2.3.1. Demonstrate how to use MS-Publisher	B8.2.3.1.3 Demonstrate the use of the commands in MS-Publisher ribbons under each tab (Home, Page Design, Mailings, Review, View) Exemplar(s): <ol style="list-style-type: none"> 1. Working in pairs, explore the use of the commands in a desktop publishing software (e.g. MS-Publisher ribbons: Home, Page Design, Mailings, Review, 	CC9.6: Ability to work with all group members to complete a task successfully. DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
	<p>B8.2.3.1.4 Change the orientation and margins of a document Exemplar(s): 1. Explore and change the orientation and margins of your document by working pairs.</p>	<p>CC9.6: Ability to work with all group members to complete a task successfully. DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.</p>
	<p>B8.2.3.1.5 Add and modify pictures from different sources Exemplar(s): 1. Explore addition and modification of pictures from different sources to your document by working in pairs.</p>	<p>CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.</p>
<p>B8.2.3.1. Demonstrate how to use MS-Publisher</p>	<p>B8.2.3.1.6 Add and modify text Exemplar(s): 1. Explore addition and modification of text using different font types in your document.</p>	<p>DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.</p>
	<p>B9.2.3.1.7 Create and present a Publisher document (flyer, advertisement, invitation cards, business cards) Exemplar(s): 1. Create a one-page Publisher document e.g. flyer, advertisement, invitation cards, business cards, etc. 2. Present documents to demonstrate creative abilities.</p>	<p>CC9.6: Ability to work with all group members to complete a task successfully CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges. DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.</p>

STRAND 2: PRODUCTIVITY SOFTWARE

SUB-STRAND 4: INTRODUCTION TO ELECTRONIC SPREADSHEET

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B8.2.4.1. Demonstrate How to Use the Spreadsheet (using functions and complex formulas)	B8.2.4.1.1. Perform operations using functions and Built-in functions Exemplar(s): <ol style="list-style-type: none"> 1. Enumerate the difference between formulas and functions. 2. Access built-in functions to perform operations on sample data. 3. Demonstrate the use of common spreadsheet functions such as SUM, AVERAGE, COUNT, COUNTA, COUNTIF, MAX and MIN. 	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
	B8.2.4.1.2 Demonstrate how to create complex formulas Exemplar(s): <ol style="list-style-type: none"> 1. Create complex formulas (e.g. finding percentages, commissions, interest rates, etc.). 	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem. CP5.1: Ability to combine information and ideas from several sources to reach a conclusion
B8.2.4.1. Demonstrate how to use the Spreadsheet. (using functions and complex formulas)	B8.2.4.1.3. Demonstrate how to copy formulas and references Exemplar(s): <ol style="list-style-type: none"> 1. Demonstrate the procedure for copying and pasting formulas in a worksheet. 2. Explore how to reference cells and ranges in a worksheet. 3. Demonstrate the use of relative and absolute cell referencing in creating formulas. 4. Explore how to correct common formula errors. 5. Complete a project that involves creating a set of formulas with common functions (e.g. simple interest formula) 	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem CP5.1: Ability to combine information and ideas from several sources to reach a conclusion

STRAND 3: COMMUNICATION NETWORKS

SUB-STRAND 1: COMPUTER NETWORKS

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B8.3.1.1. Identify the concept of computer networking for global communication	B8.3.1.1.1 Describe the data communication models for networks. Exemplar(s): <ol style="list-style-type: none"> 1. Explain the Open System Interconnection (OSI) model 2. Identify the different layers in the OSI model. 3. Discuss the purpose or benefits of the layers in ensuring interoperability of different hardware devices. 	CC9.1: Demonstrate behaviour and skills of working towards group goals
	B8.3.1.1.2 Describe the Internet, world wide web (www) and Internet Protocol (IP) addresses Exemplar(s): <ol style="list-style-type: none"> 1. Describe the Internet and the classes of internet addresses. 2. Explain the internet Domain Name Server (DNS), which is equivalent to the function of a phonebook. 3. Distinguish between IPv4 and IPv6 addresses. 4. Explore the difference between internet and world wide web (www). 	CC7.5: Identify and analyse different points of views of speaker

STRAND 3: COMMUNICATION NETWORKS

SUB-STRAND 2: INTERNET AND SOCIAL MEDIA

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
<p>B8.3.2.1 Demonstrate the use of Social Networking and Electronic Mail</p>	<p>B8.3.2.1.1 Identify the various types of Social Media sites such as Photo sharing (Instagram, Snapchat, Pinterest) and Video sharing (YouTube, Facebook Live, Periscope, Vimeo)</p> <p>Exemplars</p> <ol style="list-style-type: none"> 1. Discuss the use of Photo sharing sites such as Instagram, Snapchat, Pinterest etc. 2. Demonstrate the use of video sharing platforms such as YouTube, Facebook Live, Periscope, Vimeo etc. 3. Illustrate the steps involved in attaching a document to an email. 4. Explore the use of the address book as a feature of email. 	<p>Communication and collaboration. Explain ideas in a clear order with relevant detail, using conjunctions to structure and speech.</p> <p>Digital literacy. Recognition of societal issues raised by digital technologies</p>

STRAND 3: COMMUNICATION NETWORKS

SUB-STRAND 3: INFORMATION SECURITY

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
<p>B8.3.3.1. Recognise data threats and security protections</p>	<p>B8.3.3.1.1 Describe the nature of four major data threats (Interruption, Interception, Modification, Fabrication)</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Watch a video on threats to data security. 2. Discuss the threats that can prevent information from reaching its destination. 3. Discuss the threats that can cause data corruption. 4. Describe the nature of the four major data threats. 	<p>CC8.2: Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.</p> <p>DL6.5: Recognition of societal issues emanating from the use of digital technologies</p>
<p>B8.3.3.1. Recognise data threats and security protections</p>	<p>B8.3.3.1.2 Map the protection methods to each of the four identified data threats (Authorisation, Authentications, Encryption and Decryption)</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Brainstorm the methods of protecting data against the four main threats. 2. Describe the threats to data security and the methods of preventing each threat. 	<p>CC9.1: Demonstrate behaviour and skills of working towards group goals</p> <p>CP 5.5: Effectively evaluate the success of solutions used in an attempt to solve a complex problem.</p>

STRAND 3: COMMUNICATION NETWORKS

SUB-STRAND 4: WEB TECHNOLOGIES

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B8.3.4.1. Demonstrate the use of a web browser (Search engine)	B8.3.4.1.1 Demonstrate how to effectively search from a web browser. Exemplar(s): <ol style="list-style-type: none"> 1. Identify effective search techniques (e.g. using search phrases with exact spelling, use of AND, OR, NOT, etc. 2. Demonstrate how to search with any of the techniques or a combination of techniques. 	CP 5.5: Effectively evaluate the success of solutions used in an attempt to solve a complex problem CP6.5: Ability to select alternative(s) that adequately meet selected criteria
	B8.3.4.1.2 Explore the use of more than one search engine Exemplar(s): <ol style="list-style-type: none"> 1. Investigate the use of more than one search engine e.g. Ask, Google, yahoo! 2. Explore different search engines with the same search string/terms and observe the outcome 3. Discuss the results of your findings in Exemplar(s): 2 above. 	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem CP5.1: Ability to combine information and ideas from several sources to reach a conclusion

STRAND 4: COMPUTATIONAL THINKING

SUB-STRAND 1: INTRODUCTION TO PROGRAMMING

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B8.4.1.1. Show an understanding of the concept of programming	B8.4.1.1.1 Describe the basic concepts in programming (Constants, Variables, Expressions, Statements /Instructions, logical and arithmetic operators, Operator precedence, etc.) Exemplar(s): <ol style="list-style-type: none"> 1. Create a table to compare how the same arithmetic notations are represented in coding and in classroom mathematics. 	CP5.1: Ability to combine information and ideas from several sources to reach a conclusion.

STRAND 4: COMPUTATIONAL THINKING

SUB-STRAND 2:ALGORITHM

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
<p>B8.4.2.1.Analyse the correct step-by-step procedure in solving any real-world problem</p>	<p>B8.4.2.1.1 Apply variables, expressions, assignment statements and operator precedence order (BODMAS rule) to process and store numbers and text in a programme</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Compute an expression following the operator precedence order (BODMAS) to exemplify how computers process input data to print out ananswer. 	<p>CP 5.5: Effectively evaluate the success of solutions used in an attempt to solve a complex problem</p>
<p>B8.4.2.1.Analyse the correct step-by-step procedure in solving any real-world problem</p>	<p>B8.4.2.1.2 Describe and use sequence, selection and iteration statements in a programme. Understand the difference between variables and constants and be able to choose appropriate namingconventions when writing statements.</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Draw the four basic symbols representing programme start-stop, input-output, process and decision. 2. Identify a real case problem in the environment and arrange the symbols to represent a logical step-by-step sequence in solving that problem. (Example, illustrate the logical steps to prepare the land for a maize farm). 	<p>CP6.5: Ability to select alternative(s)that adequately meet selected criteria</p> <p>CP 5.5: Effectively evaluate the success of solutions used in an attempt to solve a complex problem</p>

STRAND 4: COMPUTATIONAL THINKING

SUB-STRAND 3: ROBOTICS

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
<p>B8.4.3.1. Discuss Robot Intelligence Concepts</p>	<p>B8.4.3.1.1 Describe the principles underlying the operation of the components of a robot (Controller Mechanical, Sensors)</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Explain the controller as the “brain” of the robot. 2. Demonstrate understanding of mechanical parts such as motors, pistons, grippers, wheels and gears that make the robot move, grab, turn around or lift (Actuators). 3. Watch video/pictures of the various parts of the robot. 4. Describe how a range of sensors can be used to input data into a computer system, including light, temperature, magnetic field, gas, pressure, moisture, humidity, pH and motion 5. Describe how these sensors are used in real-life scenarios, for example: street lights, security devices, pollution control, games, and household and industrial applications <p>NB: Sensors are used to estimate a robot’s condition and environment. The controller is run by a computer programme</p>	<p>CC8.2: Explain ideas in a clear order with relevant detail, using correct construction and structure of speech</p> <p>CP 5.2: Analyse and make distinct judgement about viewpoints expressed in an argument</p>

STRAND 4: COMPUTATIONAL THINKING

SUB-STRAND 4:ARTIFICIAL INTELLIGENCE

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
<p>B8.4.4.1 Discuss Artificial Intelligence Concepts</p>	<p>B8.4.4.1.1 Discuss Artificial Neural Networks (ANN) and compare intelligence in humans, animals and machines</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Compare intelligence in humans, animals and machines. 2. Compare the limitations and capabilities of the three intelligences in processing information 3. Discuss the difference between strong and weak artificial intelligence. 4. Discuss hologram science basics and link the application in creating a3-Dimension mixed reality (MR) intelligence. 	<p>CC9.3: Understand roles during group activities</p>

BASIC 9

STRAND I: INTRODUCTION TO COMPUTING
SUB-STRAND I: COMPONENTS OF COMPUTERS AND COMPUTER SYSTEMS

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B9.1.1.1 Identify parts of a Computer and Technology Tools	B9.1.1.1.1. Discuss the trends in the next generation of computers Exemplar(s): <ol style="list-style-type: none"> 1. Identify features expected to be seen in the next generation of computers. 2. Describe Google quantum computer (sycamore) and compare its processing power with other supercomputers (focus on processor). 	Communication and Collaboration (CC) CC7.5: Identify and analyse different points of views of speaker. CC7.3: Provide feedback in areas of ideas, organisation, voice, word choice and sentence fluency in communication.
	B9.1.1.1.2. Examine the concept of Perceptual Computing Exemplar(s): <ol style="list-style-type: none"> 1. Discuss the features of Perceptual Computing. 	CC7.5: Identify and analyse different points of views of speaker. CC7.3: Provide feedback in areas of ideas, organisation, voice, word choice and sentence fluency in communication.
	B9.1.1.1.3 Discuss the uses of Output devices such as Wearable Displays, E-Paper, E-Books, Kindle Exemplar(s): <ol style="list-style-type: none"> 1. Describe Wearable Displays (e.g. Google Glass), E-Paper, E-Books (e.g. Kindle) 	Communication and Collaboration (CC), Digital Literacy (DL) CC7.5: Identify and analyse different points of views of speaker.
	B9.1.1.1.4 Describe Storage Systems: Network and Cloud Storage Systems, Smart Cards, Holographic Storage, Storage Systems for Large Computer Systems (home servers or media servers) Exemplar(s): <ol style="list-style-type: none"> 1. Discuss Network and Cloud Storage Systems, Smart Cards, Holographic Storage, Storage Systems for Large Computer Systems (home servers or media servers). 2. Explore common cloud storage examples such as Google Drive, One Drive, etc. 3. Discuss the pros and cons of using cloud storage. 	DL5.3: Ability to find and utilise digital content. CC7.5: Identify and analyse different points of views of speaker.

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B9.1.1.2. Demonstrate the Use of the Desktop	B9.1.1.2.1 Explore personalisation of the computer Exemplar(s): <ol style="list-style-type: none"> 1. Change desktop icons. 2. Change mouse pointers. 	Communication and Collaboration (CC), Digital Literacy (DL) DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
	B9.1.1.2.2 Identify and use file management techniques (drivers and hardware) Exemplar(s): <ol style="list-style-type: none"> 1. Identify and explore the use of device drivers e. g. sound drivers and video graphic drivers 2. Explain plug-and-play devices. 3. Demonstrate how to install, update or delete drivers. 	CC7.5: Identify and analyse different points of views of speaker. DL5.3: Ability to find and utilise digital content.

STRAND 1: INTRODUCTION TO COMPUTING

SUB-STRAND 2: TECHNOLOGY IN THE COMMUNITY (COMMUNICATION)

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B9.1.2.1. Demonstrate the Use of Technology in the Community	B9.1.2.1.1. Evaluate problems in the community that can be solved with technology Exemplar(s): 1. Discuss problems in the community that can be solved using technology. Work in pairs.	Creativity and Innovation (CI), Communication and Collaboration (CC), Critical Thinking and Problem Solving (CP). CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group. CC9.2: Understand and use interpersonal skills. CP5.1: Ability to combine information and ideas from several sources to reach a conclusion.
	B9.1.2.1.2. Propose solutions to the problems identified Exemplar(s): 1. Present technological solutions to the problems identified in B9.1.2.1.1.	CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group. CP5.1: Ability to combine information and ideas from several sources to reach a conclusion.
	B9.1.2.1.3. Design the solution selected Exemplar(s): 1. Design the solution selected. 2. Present the solution designed. NB: Tasks in B9.1.2.1 is to be done as a project work	CI 5.7: Putting forward constructive comments, ideas, explanations and new ways of doing things. CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.

STRAND 1: INTRODUCTION TO COMPUTING
SUB-STRAND 3: HEALTH AND SAFETY IN THE USE OF ICT TOOLS

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B9.1.3.1. Demonstrate How to Apply Health and Safety Measures in the Use ICT Tools	B9.1.3.1.1 Evaluate health issues at workstations Exemplar(s): 1. Discuss the use of ergonomic tools such as ergonomic keyboard and paperstand. 2. Demonstrate the appropriateness of the lighting system while working with the computer.	CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.
	B9.1.3.1.2 Evaluate Safety Risk Reduction at issues at workstations Exemplar(s): 1. Discuss the heat generated by machines (e.g. computers, printers etc.) and how to reduce excess heat.	CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.

STRAND 2: PRODUCTIVITY SOFTWARE
SUB-STRAND 1: INTRODUCTION TO WORD PROCESSING

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B9.2.1.1 Demonstrate How to Use Microsoft Word (Multimedia)	B9.2.1.1.1. Demonstrate how to add pictures, insert a screenshot and screen clipping and print screen Exemplar(s): <ol style="list-style-type: none"> 1. Explore the use of the clip art, screenshot and screen clipping in the Insert Ribbon. 2. Demonstrate the use of the print screen key in capturing and inserting pictures. 	Creativity and Innovation (CI), Digital Literacy (DL) CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges. DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
	B9.2.1.1.2. Demonstrate the use of SmartArt Exemplar(s): <ol style="list-style-type: none"> 1. Illustrate the use of SmartArt in the Illustrations group of the Insert Ribbon. 	CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges. DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.
	B9.2.1.1.3. Demonstrate how to add Multimedia (audios, videos, animations), Charts and Hyperlinks Exemplar(s): <ol style="list-style-type: none"> 1. Explore the use of the clip art and screenshot in the Insert Ribbon. 	CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges. DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.

STRAND 2: PRODUCTIVITY SOFTWARE
SUB-STRAND 2: INTRODUCTION TO PRESENTATION

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B9.2.2.1 Demonstrate How to use Microsoft PowerPoint (Multimedia)	B9.2.2.1.1. Demonstrate how to add pictures and insert screenshots Exemplar(s): 1. Explore the use of the clip art and screenshot in the Insert Ribbon.	Creativity and Innovation (CI), Digital Literacy (DL) CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem
	B9.2.2.1.2. Demonstrate how to animate slides in a presentation Exemplar(s): 1. Demonstrate the use of transitions and animations. 2. Create a seven-slide presentation with animations and transitions.	CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem
	B9.2.2.1.3. Demonstrate how to add Multimedia (audios, videos etc.), tables and charts Exemplar(s): 1. Explore the use of the Insert Ribbon tab to add multimedia (e.g. audios, videos, etc.). 2. Demonstrate the use of tables and charts in slides.	CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem

STRAND 2: PRODUCTIVITY SOFTWARE
SUB-STRAND 3: INTRODUCTION TO DESKTOP PUBLISHING

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B9.2.3.1. Critique a Desktop Published Document	B9.2.3.1.1 Create and present a desktop published document (flyer, advertisement, invitation cards, business cards) Exemplar(s): 1. Create and present a four-page document with images and overflow e.g.flyer, advertisement, storybook.	Creativity and Innovation (CI), Communication and Collaboration (CC), Digital Literacy (DL), Critical Thinking and Problem Solving (CP). CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem. CC9.6: Ability to work with all group members to complete a task successfully.
	B9.2.3.1.2 Describe a desktop published document Exemplar(s): 1. Give out your document to another learner assigned to you and collect the learner's document. 2. Examine the document received in terms of the position of text and images, use of colour, mechanics, content accuracy, etc.	DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem. CP5.1: Ability to combine information and ideas from several sources to reach a conclusion CC9.6: Ability to work with all group members to complete a task successfully

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B9.2.3.1. Critique a Desktop Published Document	<p>B9.2.3.1.3 Evaluate a desktop published documentExemplar(s):</p> <ol style="list-style-type: none"> 1. Evaluate the assigned document using, but not limited to the following criteria: position of text and images, general layout of the document, use of colour, mechanics (punctuation, spelling, italics, capitalisation, etc.), and appropriateness of the design for the intended purpose. 	<p>CC9.6: Ability to work with all group members to complete a task successfully.</p> <p>CP5.1: Ability to combine information and ideas from several sources to reach a conclusion.</p>

STRAND 2: PRODUCTIVITY SOFTWARE

SUB-STRAND 4: INTRODUCTION TO ELECTRONIC SPREADSHEET

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B9.2.4.1. Demonstrate How to Use Spreadsheet (Advanced Operations)	<p>B9.2.4.1.1 Perform data filtering, sorting and validation Exemplar(s):</p> <ol style="list-style-type: none"> 1. Describe Fields (columns), Records (rows) and Tables (structured/unstructured). 2. Illustrate examples of structured and unstructured tables. 3. Construct a structured data table of class members (e.g. data table may have the following fields: Surname, First name, Date of Birth, Sex, Home Town, Region, etc). 4. Apply validation rules to check for errors. 5. Convert data tables to a list in MS Excel. 6. Demonstrate the process of entering data to a list. 7. Demonstrate the use of validation list in the Sex column (in Exemplar(s): 3) to provide options in a drop-down for data entry. 8. Demonstrate how to sort data in alphabetical order (ascending/descending) and filter data to display only selected data. 	<p>Communication and Collaboration (CC), Digital Literacy (DL), Critical Thinking and Problem Solving (CP).</p> <p>DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem</p> <p>CP5.1: Ability to combine information and ideas from several sources to reach a conclusion</p> <p>CC9.6: Ability to work with all group members to complete a task successfully</p>

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B9.2.4.1. Demonstrate how to use spreadsheet (Advanced Operations)	B9.2.4.1.2. Demonstrate how to use styles, themes, templates and macros Exemplar(s): <ol style="list-style-type: none"> 1. Describe the difference between templates and macros. 2. Create new spreadsheet documents from predefined templates in MS Excel. 3. Demonstrate the use of styles and themes on sample worksheets. 4. Do a project on formatting a dataset by applying styles and themes. 5. Explore the use of macros. 	Creativity and Innovation (CI), Communication and Collaboration (CC), Digital Literacy (DL), Critical Thinking and Problem Solving (CP). CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges. DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem. CC9.6: Ability to work with all group members to complete a task successfully.
	B9.2.4.1.3. Demonstrate the use of data tables, pivot tables, charts and pivot charts Exemplar(s): <ol style="list-style-type: none"> 1. Explore pivot tables and charts. 2. Explore the use of a pivot table to display a summary of the dataset (refer to indicator B9.2.4.1.1). 3. Insert a pivot chart to display the number of males and females in the class. 4. Demonstrate the use of the sort and filter features of the pivot table. 	CC9.6: Ability to work with all group members to complete a task successfully. CP5.1: Ability to combine information and ideas from several sources to reach a conclusion.

STRAND 3: COMMUNICATION NETWORKS

SUB-STRAND 1: COMPUTER NETWORKS

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B9.3.1.1. Know the Concept of Computer Networking for Global Communications	<p>B9.3.1.1.1 Discuss types of e-commerce and the cashless society (Bitcoin, Transaction cards, Quick Response code (QR) payment system)</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Explore the use of the Internet to engage in online business: selling, buying and paying for products online. 2. Discuss the use of online banking systems (e.g. using mobile money, bitcoin, the use of MasterCard, Visa card, QR code payment system, etc.). 	<p>Digital Literacy (DL), Communication and Collaboration (CC)</p> <p>DL5.3: Ability to find and utilise digital content</p> <p>CC8.5: Vary the level of detail and the language used when presenting to make it appropriate to the audience</p>
	<p>B9.3.1.1.2 Justify eLearning potentials</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Explain the concept of eLearning, its benefits and disadvantages. 2. Discuss projects on a collaborative platform (e.g. iBox network, the use of a ad hoc network to share resources, Wikis, Google Docs] etc.) 	<p>CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group</p> <p>DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem</p>

STRAND 3: COMMUNICATION NETWORKS

SUB-STRAND 2: INTERNET AND SOCIAL MEDIA

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B9.3.2.1 Demonstrate the Use of Social Networking and Electronic Mail	<p>B9.3.2.1.1 Identify the advantages and risks in the use of social media platforms</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Illustrate the benefits of using social media sites 2. Discuss the issues and risks surrounding the usage of social media platforms and how to avoid them. 3. Explore reply, reply all, forward and forward all features in the use of emails 	<p>DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem.</p>

STRAND 3: COMMUNICATION NETWORKS

SUB-STRAND 3: INFORMATION SECURITY

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
<p>B9.3.3.1. Recognise data threats and the means of protection</p>	<p>B9.3.3.1.1 Discuss cyberbullying, cyberstalking, digital footprint and digital shadow on the Internet</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Watch a film or do a reading on cyberbullying, cyberstalking, digital footprint, digital shadows. 2. Discuss the nature of cyberbullying, cyberstalking, digital footprint and digital shadows. 3. Identify examples of cyberbullying, cyberstalking, digital footprint and digital shadows. 4. Discuss the effects on cyberbullying on individuals 	<p>Creativity and Innovation (CI), Digital Literacy (DI), Critical Thinking and Problem Solving (CP), Communication and Collaboration (CC)</p> <p>DL 6.1: Understand the sociological and emotional aspects of cyberspace</p> <p>CP 6.4: Ability to identify important and appropriate criteria and use them to evaluate available alternatives</p> <p>CC8.5: Vary the level of detail and the language used when presenting to make it appropriate for the audience</p>
<p>B9.3.3.1. Recognise data threats and the means of protection</p>	<p>B9.3.3.1.2 Explain ten (10) information hacking techniques on the Internet environment.</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Brainstorm information hacking techniques on the internet environment. 2. Explain ten (10) information hacking techniques e.g. phishing, keyloggers, Denial of Service attack, eavesdropping, etc. 	<p>DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem</p>

STRAND 3: COMMUNICATION NETWORKS

SUB-STRAND 4: WEB TECHNOLOGIES

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B9.3.4.1 Demonstrate the Use of a Web Browser (Blogging)	B9.3.4.1.1 Examine the importance of creating blogs Exemplar(s): 1. Discuss the importance of creating blogs.	Creativity and Innovation (CI), Digital Literacy (DL). CI 6.6: Being open-minded, adapting and modifying ideas to achieve creative results. DL5.3: Ability to find and utilise digital content
	B9.3.4.1.2 Develop a blog for the school or a social club Exemplar(s): 1. Investigate the items to include in a school or social club blog. 2. Develop a blog for the school or a social club.	DL6.3: Use digital tools to create novel things
	B9.3.4.1.3 Explore the steps in publishing a blog Exemplar(s): 1. Identify steps in publishing a blog. 2. Demonstrate the procedure for publishing a blog and invite others to comment.	DL6.3: Use digital tools to create novel things

STRAND 4: COMPUTATIONAL THINKING

SUB-STRAND 1: INTRODUCTION TO PROGRAMMING

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B9.4.1.1. Show an Understanding of the Concept of Programming	B9.4.1.1.1 Describe the conversion of decimal into binary data type for computer to recognise the meaning, process and store Exemplar(s): <ol style="list-style-type: none"> 1. Convert decimal, binary and hexadecimal data from one format to another. 2. Show the results of calculating two or more binary numbers using the mathematical notation or operators in the number base two rule. 	Creativity and Innovation (CI), Critical Thinking and Problem Solving (CP). CP 5.5: Effectively evaluate the success of solutions used in an attempt to solve a complex problem
	B9.4.1.1.2 Identify the different tools which are accessible in Integrated Development Environment (IDE) to aid the development of codes Exemplar(s): <ol style="list-style-type: none"> 1. Explore programming languages such as Snap, Scratch and Python to explain the key terminologies (variables, operators, controls, events, etc.) around the coding environment. <p>Explore a web development programme to create a simple website.</p>	CI 5.5: Ability to try new alternatives and different approaches. CP 6.6: Preparedness to recognise and explain results after implementation of plans.

STRAND 4: COMPUTATIONAL THINKING

SUB-STRAND 2:ALGORITHM

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
B9.4.2.1.Analyse the Correct Step-by-step Procedure in Solving any Real-world Problem	B9.4.2.1.1 Write a programme using flowchart and Pseudocode algorithm that includes sequence, selection and iteration choices in problem-solving Exemplar(s): <ol style="list-style-type: none"> 1. Discuss at least three ways to do proper hand-washing and prepare beverages with or without sugar and/or milk. 2. Write an algorithm for Exemplar(s): 1 that focuses on procedure correctness and shortest time to execute. 	Creativity and Innovation (CI),Critical Thinking and ProblemSolving (CP). CI6.1: Exhibit strong memory, intuitive thinking; and respond appropriately. CP 6.4: Ability to identify important and appropriate criteria and use them to evaluate available alternatives.
	B9.4.2.1.2 Translate a Flowchart algorithm to Pseudocode format andvice versa Exemplar(s): <ol style="list-style-type: none"> 1. Write an algorithm using flowchart format. Convert or translate the same flowchart algorithm into a Pseudocode format. (do a vice versa translation example to reinforce critical thinking) 	CI5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges.

STRAND 4: COMPUTATIONAL THINKING

SUB-STRAND 3: ROBOTICS

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
<p>B9.4.3.1. Discuss Robot Intelligence Concepts</p>	<p>B9.4.3.1.1 Construct a robot artefact using available lab components and tools or emulator/simulator software pack.</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Explain the three basic laws of robotics by Isaac Asimov i.e. Asimov's science fiction laws of robotics. 2. Demonstrate how a robot is assembled using real robots' toolkit/video/pictures. 3. Explore a robotic software pack, e.g. Scratch, Webot, Snap, Mbot software, EV3 and Mobile Applications such as lightbot 	<p>Creativity and Innovation (CI), Critical Thinking and Problem Solving (CP).</p> <p>CI 6.3: Ability to select the most effective creative tools for work and give reasons for the choice</p> <p>CP 5.4: Generate hypothesis to help answer complex problems</p>

STRAND 4: COMPUTATIONAL THINKING

SUB-STRAND 4: ARTIFICIAL INTELLIGENCE

CONTENT STANDARD	INDICATORS AND EXEMPLAR(S)	CORE COMPETENCIES
<p>B9.4.4.1 Discuss Artificial intelligence Concepts</p>	<p>B9.4.4.1.1. Describe the knowledge-based systems (Expert systems) as the classical Artificial intelligence</p> <p>Exemplar(s):</p> <ol style="list-style-type: none"> 1. Illustrate the use of IF-THEN control structure for querying an expert system 2. Demonstrate how to input a request in any knowledge-based system to generate an output or result (e.g. Telemedicine system) 3. Demonstrate how to go onto the web and use Google's Teachable Machine demo to get a basic understanding of how machine learning works (e.g. What is it as an open-source cloud-based app which can identify the object in an image/photo) <p>NB: Demonstrate how data is collected and the extent to which information can be used. Also discuss thoughts on machine learning. https://teachablemachine.withgoogle.com</p>	<p>Communication and Collaboration (CC), Critical Thinking and Problem Solving (CP)</p> <p>CC8.2: Explain ideas in a clear order with relevant detail, using correct construction and structure of speech.</p> <p>CP 6.6: Preparedness to recognise and explain results after implementation of plans.</p>

GLOSSARY

1. **Holographic storage** It is a computer storage device that uses beams of light to store three-dimensional digitally created data.
2. **Cloud Storage** Includes saving data in a remote physical location that can be accessed through the Internet from any device.
3. **Wearable computer** It is a technology tool that a customer can wear usually to monitor health and fitness-related information.
4. **E-Paper** It is a technology that makes this easy to read text on an electronic gadget.
5. **E-Books** An electronic version of a physical book that can be read on a screen or a handheld device specifically designed for reading.
6. **Kindle** This is the first portable hardware computer released in the U.S. Kindle shows images and text using E ink, and can use Sprint's Evolution-Data Optimised (EVDO) to get e-books over the Amazon Whispernet.
7. **Smart Cards** A plastic card with a built-in microprocessor, used typically to perform financial transactions.
8. **Sensors** A device which detects or measures a physical property and records, indicates, or otherwise responds to it.
9. **BODMAS** This is an acronym and it stands for Bracket, Of, Division, Multiplication, Addition and Subtraction. It is an order of operations which includes a collection of rules that reflect conventions about which procedures to perform first in order to evaluate a given mathematical expression.
10. **Quantum** Quantum computing is the use of quantum-mechanical phenomena such as superposition and entanglement to perform computation. A quantum computer is used to perform such computation, which can be implemented theoretically or physically.
11. **Sycamore** Sycamore is the name of Google's quantum processor comprising 54 qubits (quantum bits). Sycamore achieved its results using exactly 53 qubits. A 54th one on the chip failed.

APPENDICES

APPENDIX 1: CORE COMPETENCIES AND SUBSKILLS OF THE COMMON CORE PROGRAMME (CCP)

1. COMMUNICATION AND COLLABORATION (CC)

B7-B9		
CC7: LISTENING	CC8: PRESENTING	CC9: TEAMWORK
CC7.1: Identify words or sentences in context appropriately	CC8.1: Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group	CC9.1: Demonstrate behaviour and skills of working towards group goals
CC7.2: Interpret correctly and respond to non-verbal communication such as facial expressions, cues and gestures	CC8.2: Explain ideas in a clear order with relevant detail, using correct construction and structure of speech	CC9.2: Understand and use interpersonal skills
CC7.3: Provide feedback in areas of ideas, organisation, voice, word choice and sentence fluency in communication	CC8.3: Apply appropriate diction, and structure sentences correctly for narrative, persuasive, imaginative and expository purposes	CC9.3: Understand roles during group activities
CC7.4: Identify underlying themes, implications and issues when listening	CC8.4: Anticipate different responses from the audience and plan for them	CC9.4: Help group work on relevant activities
CC7.5: Identify and analyse different points of views of speaker	CC8.5: Vary the level of detail and the language used when presenting to make it appropriate to the audience	CC9.5: Appreciate the importance of including all team members in discussions and actively encourage contributions from them
		CC9.6: Ability to work with all group members to complete a task successfully
		CC9.7: Effectively perform multiple roles within the group
		CC9.8: Demonstrate an awareness of the wider team dynamics and work to minimise conflicts in the team

2. CRITICAL THINKING AND PROBLEM SOLVING (CP)

B7-B9	
CP5: CRITICAL THINKING	CP6: PROBLEM SOLVING
CP 5.1: Ability to combine information and ideas from several sources to reach a conclusion	CP 6.1: Ability to effectively define goals towards solving a problem
CP 5.2: Analyse and make distinct judgement about viewpoints expressed in an argument	CP 6.2: Ability to explain plans for attaining goals
CP 5.3: Create simple logic trees to think through problems	CP 6.3: Identify important and appropriate alternatives
CP 5.4: Generate hypothesis to help answer complex problems	CP 6.4: Ability to identify important and appropriate criteria and use them to evaluate available alternatives
CP 5.5: Effectively evaluate the success of solutions used in an attempt to solve a complex problem	CP 6.5: Ability to select alternative(s) that adequately meet selected criteria
CP 5.6: Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation	CP 6.6: Preparedness to recognise and explain results after implementation of plans
CP 5.7: Provide new insight into controversial situation or task	CP 6.7: Implement strategies with accuracy
CP 5.8: Identify and prove misconceptions about a generalised concept or fact specific to a task or situation	
CP 5.9: Identify and explain a confusion, uncertainty or a contradiction surrounding an event	
CP 5.10: Develop and defend a logical plausible resolution to a confusion, uncertainty or contradiction surrounding an event	

3. PERSONAL DEVELOPMENT AND LEADERSHIP (PL)

B7-B9	
PL5: PERSONAL DEVELOPMENT	PL6: LEADERSHIP
PL5.1: Understanding oneself (strengths, weaknesses, goals and aspirations) in reacting and adjusting to novel situations	PL6.1: Ability to serve group members effectively
PL5.2: Demonstrate a sense of belonging in a group	PL6.2: Division of tasks into solvable units and assigning group members to task units
PL5.3: Recognise one's emotional state and their preparedness to apply emotional intelligence	PL6.3: Ability to manage time effectively
PL5.4: Ability to understand one's personality traits	PL6.4: Ability to manage and resolve conflicts
PL5.5: Desire to accept one's true self and overcome weaknesses	PL6.5: Ability to monitor team members to ascertain progress
PL5.6: Ability to set and maintain personal standards and values	PL6.6: Ability to mentor peers
	PL6.7: Actively promote effective group interaction and the expression of ideas and opinions in a way that is sensitive to the feelings and background of others
	PL6.8: Actively assist group identify changes or modifications necessary in the group activities and work towards carrying out those changes

4. CULTURAL IDENTITY AND GLOBAL CITIZENSHIP (CG)

B7-B9	
CG5: CULTURAL IDENTITY	CG6: GLOBAL CITIZENSHIP
CG5.1: Show a strong sense of belonging to one's culture	CG6.1: Understanding of influences of globalisation on traditions, languages and cultures
CG5.2: Develop and exhibit ability to defend one's cultural beliefs, practices and norms	CG6.2: Recognise resistance to global practices that are inimical to our culture
CG5.3: Develop and express respect, recognition and appreciation of others' cultures	CG6.3: Know the global discourse about the roles of males and females
CG5.4: Develop and exhibit a sense of cultural identity	CG6.4: Exhibit a sense of nationality and global identity
CG5.5: Adjust to the demands of customs, traditions, values and attitudes of society	

5. CREATIVITY AND INNOVATION (CI)

B7-B9	
CI5: KNOWLEDGE, UNDERSTANDING, SKILLS AND STRATEGIES	CI6: REFLECTION AND EVALUATION
CI 5.1: Examine alternatives in creating new things	CI 6.1: Exhibit strong memory, intuitive thinking and respond appropriately
CI 5.2: Ability to merge simple/complex ideas to create novel situations or things	CI 6.2: Ability to reflect on approaches to creative tasks and evaluate the effectiveness of tools used
CI 5.3: Identification of requirements of a given situation and justification of more than one creative tool that will be suitable	CI 6.3: Ability to select the most effective creative tools for work, and give reasons for the choice
CI 5.4: Ability to visualise alternatives, see possibilities and identify problems and challenges	CI 6.4: Imagining and seeing things in a different way
CI 5.5: Ability to try new alternatives and different approaches	CI 6.5: Anticipate and overcome difficulties relating to taking initiatives
CI 5.6: Understand and use analogies and metaphors	CI 6.6: Being open-minded, adapting and modifying ideas to achieve creative results
CI 5.7: Putting forward constructive comments, ideas, explanations and new ways of doing things	CI 6.7: Look and think about things differently and from different perspectives
	CI 6.8: Recognise and generalise information and experience; search for trends and patterns
	CI 6.9: Interpret and apply learning in new contexts
	CI 6.10: Reflect on work and explore the thinking behind thoughts and processes

6. DIGITAL LITERACY (DL)

B7-B9	
DL5: PHOTO-VISUAL AND INFORMATION LITERACY	DL6: SOCIO-EMOTIONAL AND REPRODUCTION LITERACY
DL5.1: Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use it to solve a problem	DL 6.1: Understand the sociological and emotional aspects of cyberspace
DL5.2: Ability to recognise and avoid traps in cyberspace	DL 6.2: Create a meaningful and original piece of work, or its interpretation by integrating existing information
DL5.3: Ability to find and utilise digital content	DL6.3: Use digital tools to create novel things
DL5.4: Ability to construct knowledge from a non-linear hyper-textual navigation	DL6.4: Adhere to behavioural protocols that prevail in cyberspace
DL5.5: Evaluate the quality and validity of information	DL6.5: Recognition of societal issues emanating from the use of digital technologies
DL5.6: Preparedness to make better decisions using available information	DL6.6: Knowledge and recognition of ethical use of information

Please note these inclusivity issues

The core competencies outlined in this document must be assessed taking into consideration learners with special needs (physical disabilities, learning disabilities, etc.).

Consider the use of realia for visual and visually challenged

learners. A system of creating alternatives for tasks must also be

adopted.

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