Topic	National 4	National 5	Higher
Languages and environments			Description of the key characteristics of the following language types: □ low-level □ high-level □ procedural □ declarative □ object-oriented

Computational constructs	Exemplification and implementation of the following constructs:
	□ expressions to assign values to variables
	□ expressions to return values using arithmetic operations (+, -, *, /, ^)
	□ execution of lines of code in sequence demonstrating input – process – output
	□ use of selection constructs including simple conditional statements
	□ iteration and repetition using fixed and conditional loops
		Exemplification and implementation of the following constructs:
		□ expressions to assign values to variables
		□ expressions to return values using arithmetic operations (+, -, *, /, ^, mod)
		□ expressions to concatenate strings and arrays using the & operator
		□ use of selection constructs including simple and complex conditional statements and logical operators
		□ iteration and repetition using fixed and conditional loops
		□ pre-defined functions (with parameters)
			□ parameter passing (value and reference, formal and actual)
			□ scope, local and global variables
			□ sub-programs/routines, defined by their name and arguments (inputs and outputs), including
			   o functions
			   o procedures
			   o methods

Data types and structures	□ String □ numeric (integer) variables □ graphical objects	□ String, character □ numeric (integer and real) variables □ Boolean variables □ 1-D arrays	□ string □ numeric (integer and real) variables □ Boolean variables □ 1-D arrays and records (including arrays of records) □ sequential files (open, create, read, write, close)

Testing and documenting solutions	□ normal, extreme and exceptional test data
	□ readability of code
	   o internal commentary
	   o meaningful variable names
		□ normal, extreme and exceptional test data
		□ syntax, execution and logic errors
		□ readability of code
		   o internal commentary
		   o meaningful identifiers
		   o indentation
			□ constructing a test plan
			□ comprehensive testing
			□ syntax, execution and logic errors
			□ dry runs
			□ trace tables /tools
			□ breakpoints

Algorithm specification		Exemplification and implementation of algorithms, including □ input validation	Analysis, exemplification and implementation of algorithms including: □ input validation □ linear search □ find minimum and maximum □ count occurrences Analysis of other algorithms of similar complexity

Topic	National 4	National 5	Higher
Low-level operations and computer architecture	Use of binary to represent and store: ☐ positive integers ☐ characters ☐ instructions (machine code) Units of storage ☐ bit ☐ Byte ☐ KB ☐ MB ☐ GB ☐ TB ☐ PB	Translation of high-level program code to binary (machine code): interpreters and compilers Use of binary to represent and store: ☐ integers and real numbers ☐ characters ☐ instructions (machine code) ☐ graphics (bit-mapped and vector) Basic computer architecture: ☐ processor (registers, ALU, control unit), ☐ memory, ☐ buses (data and address), ☐ interfaces	virtual machines emulators mobile devices Use of binary to represent and store: ☐ integers and real numbers ☐ characters ☐ instructions (machine code) ☐ graphics (bit-mapped and vector) ☐ sound ☐ video Computer architecture (trends and implications): ☐ processor (registers, ALU, control unit) ☐ cache ☐ memory ☐ buses (data and address) ☐ interfaces
Design notations	☐ graphical to illustrate selection and iteration ☐ other contemporary design notations	☐ pseudocode to exemplify programming constructs other contemporary design notations	☐ structure diagram ☐ entity relationship diagram ☐ data dictionary ☐ pseudocode ☐ wire-framing ☐ other contemporary design notations
Development methodologies			Iterative phases of development process: Analysis Design Implementation Testing Documentation Evaluation Maintenance. Development methodologies: ☐ rapid application development ☐ top-down/step-wise refinement ☐ Agile methodologies

Topic	National 4	National 5	Higher
Contemporary developments			Exemplification of trends in the development of: □ software development languages □ software development environments □ intelligent systems □ online systems
User interface		User requirements □ visual layout □ navigation □ selection □ consistency □ interactivity □ readability	□ usability □ accessibility

Structures and links (database)	□ database structure: field, record, file
	□ field types
	   o text
	   o number
	   o date/time
	   o graphic
	   o calculated
	□ database operations (search, sort)
		□ database structure:
		   o flat file
		   o linked tables
		   o primary keys
		   o foreign keys
		□ field types
		   o text
		   o number
		   o date/time
		   o graphic
		   o object
		   o calculated
		   o link
		   o Boolean
		□ validation including:
		   o presence check
		   o restricted choice
		   o field length
		   o range
		□ database operations search, sort (on multiple fields)
		□ good design to avoid data duplication and modification errors (insert, delete, update)
			□ database structures: relational
			□ primary keys, including compound keys
			□ relationships
			   o one-to-one
			   o one-to-many
			   o many-to-many
			□ complex database operations
			   o queries
			   o forms
			   o reports
			   o calculating

Topic	National 4	National 5	Higher
Structures and links (web-based)	□ website, page, URL □ hyperlink	□ website, page, URL □ hyperlinks (internal, external), relative and absolute addressing □ navigation □ web browsers and search engines □ good design to aid navigation, usability and accessibility	□ site structure: multi-level □ page structure □ head □ title □ body □ cascading style sheets □ meta tags □ dynamic web pages □ database-driven website □ interactive web page
Media types	Sound, graphics, video, text	Standard file formats: □ text: txt, rtf □ audio: wav, mp3 □ graphics: jpeg, bmp, gif, png □ video: mp4, avi □ pdf Factors affecting file size and quality, including □ resolution □ colour depth □ sampling rate □ Calculation of file size for colour bitmap. Need for compression	Compression: lossy and lossless compression techniques applied to: □ sound □ graphic □ video
Coding		Exemplification and implementation of coding to create and modify information systems, including the use of: □ scripting languages (including JavaScript) □ mark-up languages (including HTML)	Exemplification and implementation of coding to create and modify information systems including the use of: □ scripting (database/web pages) □ client-side scripting □ server-side scripting □ optimisation (web search (crawlers) and efficiency of coding)

Testing		□ Links and navigation
		□ Matches user interface design
			□ Beta testing
			□ Usability
			□ Compatibility issues
			  o memory
			  o storage requirements
			  o OS compatibility

Purpose, functionality, users	Simple descriptions of main features and functionality	□ Description of purpose
		Users: expert, novice, age-range
			□ detailed descriptions of purpose
			□ Interaction of information systems with:
			  o human users: expert, novice, age-range
			  o other software: search engines

Topic	National 4	National 5	Higher

Technical Implementation (hardware requirements)	□ input and output devices
	□ processor clock speed (Hz)
	□ memory (RAM, ROM)
		□ input and output devices
		□ processor type and speed (Hz)
		□ memory (RAM, ROM)
		□ device type including:
		  o supercomputer
		  o desktop
		  o portable devicesincluding:
		    ▪ laptop
		    ▪ tablet
		    ▪ smartphone
			□ input and output devices
			□ processor type, number and speed (Hz)
			□ memory
			  o RAM
			  o ROM
			  o cache
			□ device type
			  o Desktop
			  o Laptop
			  o Tablet
			  o Smartphone

Technical Implementation (software requirements)	□ operating system platform required	□ operating systems □ web browsers specific applications and/or utilities	□ operating systems □ licensing □ proprietary v open source □ portability Description and exemplification of current trends in operating system design
Technical implementation (storage)	Storage devices □ built-in, external, portable □ magnetic, optical □ capacity, speed □ rewritable, read-only	□ local, web, cloud □ capacity (in appropriate units) □ rewritable, read-only □ interface type □ data transfer speed storage devices: □ built-in, external, portable □ magnetic, optical □ solid state	□ distributed and off-line storage □ backup systems and strategy □ capacity (in appropriate units) □ rewritable, read-only □ interface type □ data transfer speed Storage devices: □ built-in, external □ magnetic, optical □ solid state Description and exemplification of current trends in storage systems.
Technical implementation (networking/ connectivity)	□ stand-alone or networked □ LAN/internet □ wired/wireless	□ peer-to-peer, client/server □ wired, optical, wireless	Cloud systems and server provision: □ public, private, hybrid □ cloud-based services □ web hosting Description and exemplification of current trends in networking and connectivity.

Topic	National 4	National 5	Higher
Security risks	☐ viruses, worms, Trojans ☐ hacking	☐ spyware, phishing, keylogging ☐ online fraud, identity theft ☐ DOS (Denial of Service) attacks	☐ spyware, phishing, keylogging ☐ online fraud, identity theft ☐ DOS (Denial of Service) attacks
Security precautions		☐ anti-virus software ☐ passwords/encryption ☐ biometrics ☐ security protocols and firewalls ☐ use of security suites	☐ encryption ☐ digital certificates and signatures ☐ server-side validation of online form data ☐ Biometrics in industry
Legal implications		Basic descriptions and implications of: ☐ Computer Misuse Act ☐ Data Protection Act ☐ Copyright, Designs and Patents Act (plagiarism) ☐ Health and Safety regulations ☐ Communications Act	Detailed descriptions and implications of : ☐ Computer Misuse Act ☐ Data Protection Act ☐ Copyright Designs and Patents Act (plagiarism) ☐ Communication Acts ☐ Regulation of Investigatory Powers Act
Environmental implications		☐ Energy use ☐ Disposal of IT equipment ☐ Carbon footprint	☐ lifetime carbon footprint (manufacture, use, disposal) ☐ environmental benefits

Economic and social impact			☐ economic:
			  o competitive advantage
			  o global marketplace
			  o business costs
			  o maintainability
			  o scalability
			☐ social:
			  o censorship and freedom of speech
			  o privacy and encryption
			  o global citizenship
			  o online communities