Information and Communication Technology Curriculum and Assessment Guide (S4-6) Supplementary Notes (Edit Mode)

1. Curriculum Framework

Comparison between current curriculum framework with the proposed one that will be applicable to 2025 HKDSE examination and onwards.

Current Curriculum Framework (Before 2025 HKDSE)

The Compulsory Part (145 hours)			
A. Information Processing	(52 hours)	B. Computer System Fundamentals	(25 hours)
C. Internet and its Applications	(22 hours)	D. Basic Programming Concepts	(24 hours)
E. Social Implications	(22 hours)		

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The Elective Part (75 hours) (Choose one only)			
A. *Databases*	B. *Data Communications and Networking*	C. *Multimedia Production and Web Site Development*	D. *Software Development*

Revised Curriculum Framework (2025 HKDSE onward)

The Compulsory Part (**144** hours)			
A. Information Processing	(**37** hours)	B. Computer System Fundamentals	(**20** hours)
C. Internet and its Applications	(**31** hours)	D. **Computational Thinking and Programming**	(**48** hours)
E. Social Implications	(**8** hours)		

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The Elective Part (**76** hours) (**Choose any two**)		
A. *Databases*	B. *Web Application Development*	C. *Algorithm and Programming*

2. Changes on the curriculum

Changes are highlighted in RED and applicable to the 2025 HKDSE examination and onwards.

Page number highlighted in BLUE denotes the page number in the booklet Information and Communication Technology Curriculum and Assessment Guide (Secondary 4-6) (2015)
(URL: https://334.edb.hkedcity.net/doc/chi/curriculum2015/ICT_CAGuide_e_2015.pdf)

Compulsory Part (144 hours)

Module / Topic	Revised content	
	Learning Outcomes	**Remarks**
A. Information Processing		
a. Introduction to Information Processing (3 hours) (Page 11)	● ~~Describe the basic concepts of the Input-Process-Output cycle and the use of a stored program in a processing system.~~	
c. Data Representation (10 hours) (Page 13)	● Know briefly how different multimedia elements are digitised. Convert them into different file formats and compare them for storing the same data.	● ~~Elementary file conversion is required but not the editing of a file. Students should be given the experience in creating various file formats such as wav vs. mp3, bmp vs. jpg, and avi vs. mpeg2.~~ Common file formats such as bmp, png, jpg, wav, mp3, avi, mpeg4, txt, docx, odt and pdf.
d. ~~The Use of Office Automation Software (28 hours)~~ Data Manipulation and Analysis (20 hours) (Page 14-16)	● ~~Design and create formatted documents or reports effectively and suitably using a word processing tool.~~	● ~~Through meaningful tasks related to the real world, such as advertisements fliers, newsletters and reports, students are expected to apply formatting features such as tables, columns, text frames and graphics, with consideration of the use of colour, size and positioning in presenting their documents.~~ ● ~~Other features such as table of contents and hyperlinks should be introduced to students to facilitate the writing of a report and to enhance the readability of documents.~~

Module / Topic	Revised content	
	Learning Outcomes	**Remarks**
	● ~~Convert between various document / text formats and justify their usage.~~	● ~~Examples of text formats are rich text format, portable document format and word document format.~~
	● ~~Understand concepts of Object Linking and Embedding (OLE) and its applications.~~	
	● ~~Use a software suite in an integrated and effective manner.~~	● ~~Students should be given experience of the integrated use of different programs in the software suite (e.g. spreadsheet / databases with word documents in mail merging).~~
e. ~~Presentation of Information (5 hours)~~ *(Page 16)*	● ~~Construct and design a presentation incorporating multimedia elements.~~	● ~~The focus is on the planning of the storyboard and presentation, not the means of presentation. Students may choose a web-based presentation, a slide show, a multimedia document or other means of presentation.~~ ● ~~The presentation should be supplemented with verbal annotation, to develop students' communication skills and encourage them to articulate ideas / thoughts.~~
B. Computer System Fundamentals		
a. Basic Machine Organisation (14 hours) *(Page 18)*	● Explain the functions of hardware within a computer system, namely input and output devices, processing units, bus system and storage devices (both primary and secondary).	● Processing units include central processing unit (CPU) and graphics processing unit (GPU).

Module / Topic	Revised content	
	Learning Outcomes	**Remarks**
	● Outline the steps in the fetch-decode-execute cycle and store using a single processor, and describe the roles of and the interdependence among components, registers and buses in the machine cycle.	● ~~The functions of the program counter, accumulator, instruction register, memory address register and memory data register should be briefly introduced to students. No assembly language is involved but instructions requiring LOAD, ADD, STORE and STOP may be used to illustrate how data and instructions are processed in the machine cycle.~~
b. System Software (6 hours) *(Page 20)*	● Distinguish the characteristics and applications of various modes of operation.	● Modes of operation to be considered are batch processing, real-time processing, parallel processing, distributed processing, and virtualisation.
c. ~~Computer Systems (6 hours)~~ *(Page 21)*	*(All the content in this topic is removed)*	
C. Internet and its Applications		
a. Networking and Internet Basics (9 hours) *(Page 23-24)*	● Know the formats and functions of IPv4 and IPv6.	● Technical details are not required.

Module / Topic	Revised content	
	Learning Outcomes	**Remarks**
	● Explain the functions of the hardware required for a network	● This includes communication links (~~phone line, coaxial cable,~~ fibre optics, microwave, Unshielded Twisted Pair (UTP) cable, satellite, etc.), modem ~~(including cable modem)~~, network interface card, network connecting devices (~~hub,~~ switch and router, etc.). ● The common industry standards for wireless computer networks should be introduced to students. Relevant concepts including frequency, bandwidth, interference and roaming, etc. are required.
	● Understand the need for communications software and communication protocols.	● This includes simple concepts of TCP/IP.
	● Describe how data is transmitted over the Internet and understand concepts of Uniform Resource Locator (URL), Domain Name System (DNS), Hypertext Transfer Protocol (HTTP) and ~~File Transfer Protocol (FTP)~~ Hypertext Transfer Protocol Secure (HTTPS).	

Module / Topic	Revised content	
	Learning Outcomes	**Remarks**
b. Internet Services and Applications (5 hours) *(Page 25)*	● Value and appraise the significance of the development and expansion of the Internet for various activities in society.	● ~~The benefits and limitations of various activities, such as e-commerce, e-government, e-learning and e-entertainment, as compared to the traditional methods, should be discussed. In e-commerce, for instance, this may range from activities such as Electronic Fund Transfer (EFT) to current practices in corporate / organisation web portals in the digital economy.~~ ● ~~Appreciation of technology advancement as a change agent for the betterment of humanity should be fostered among students.~~ ● Appreciation of the use of Internet applications for the improvement of human life should be fostered among students. For instance, smart city can be achieved with Internet of things (IoT) and cloud services.
c. Elementary Web Authoring (3 hours) *(Page 26)*	● ~~Design and construct~~ Discuss the organisation of web pages for an intended audience and upload them onto the World Wide Web.	

Module / Topic	Revised content	
	Learning Outcomes	**Remarks**
d. Threats and Security on the Internet (14 hours) *(Topics are captured from Core Part Module E "Social Implications" and Elective Part Option B "Data Communications and Networking")*	● Describe the potential risks caused by the common network security threats.	● The threats include virus, worm and Trojan programs, spyware, ransomware, unauthorised access, interception, intrusion via dynamic web pages and Denial of Service (DoS) attack, etc.
	● Propose effective measures to improve network security.	● The measures include browser setting, anti-virus software, authentication, access and user right control, firewall, wireless security protocol such as WPA, and Virtual Private Network (VPN), etc.
	● Discuss the possible privacy threats on the Internet, and suggest ways to maintain privacy.	● Supported by crimes reported in the news, violation of the secrecy of data as a result of eavesdropping, hacking, phishing, spamming and junk mails etc. should all be considered and discussed with students. ● The ways to maintain privacy, such as anonymity and passwords, should be stressed. ● Teachers can quote some of the legal consequences related to unauthorised access to computers.
	● Be aware of information encryption technologies so as to prevent eavesdropping and interception.	● This includes the basic concepts of data encryption, public and private key encryption systems (e.g. Hong Kong Public Key Infrastructure (PKI)), and the relationship between the size of the key used and the degree of security.

Module / Topic	Revised content	
	Learning Outcomes	**Remarks**
	● Explain authentication and authorisation as a means to control access of information on the Internet.	● Basic concepts include the authentication methods for individuals, types of tokens used in authentication processes, and the procedures of authenticating a digitally signed document by obtaining a digital certificate of the signed body.
	● Know about security used in electronic transactions.	● The concepts of Secure Sockets Layer (SSL) in secured transmission in e-commerce should be introduced. ● Other security measures in online transaction such as smart cards, security tokens, digital certificates and mobile Short Message Service (SMS) should also be introduced.
	● Be aware of the latest developments in security measures.	
D. Computational Thinking and Programming		
a. Problem-Formulation and Analysis (5 hours) (Page 28)	● ~~Outline the major stages in problem-solving and explain the needs of each stage.~~	
	● ~~Use real-life examples to illustrate the various stages in problem-solving procedures.~~	
	● ~~Explain the importance of formulating and defining the scope of a problem precisely.~~	
	● Define a problem and its scope.	

Module / Topic	Revised content	
	Learning Outcomes	**Remarks**
	● Analyse a problem by identifying required inputs and outputs as well as stating the processes required.	● Examples: ■ Calculate interest on mortgages and list the instalments ■ Find the Body Mass Index (BMI) to monitor for healthy weight ■ Program a robot to detect and trace lines
	● ~~Solve a problem by breaking it down into sub-problems or modules.~~ Solve a problem by decomposing them into smaller and manageable sub-problem.	● The sub-problems, for instance, may represent the input, process and output of the solution to the problem.
	● Identify common elements across similar problems.	● Example: ■ Identify the patterns of methods for sorting the height of a group of students in ascending order and then modify the methods to sort the weight of a group of students in descending order. ■ Identify the patterns of methods for programming a robot to move in a square and then modify the programs to let the robot move in other polygons.
b. Algorithm Design (12 hours) (Page 28-29)	● Perform a dry run of a set of steps to determine its purpose and/or output.	
	● Produce trace table to show value of variables at each stage in set of steps.	
	● Locate logic error in an algorithm, and correct or modify an algorithm to remove the errors or for changes in task specification.	

Module / Topic	Revised content	
	Learning Outcomes	**Remarks**
c. Program Development (20 hours) *(New)*	• Understand and use variables, constants, and simple lists (1-D array) in different problem contexts.	
	• Use operators, expressions, assignment statements, input and output statements.	• Examples of arithmetic operators include addition, subtraction, multiplication, division, and modulus. • Examples of relational operators include equal to, not equal to, greater than, greater than or equal to, less than and less than or equal to. • Examples of Boolean expression include AND, OR and NOT.
	• Understand and use sequence, selection and iteration (nested loop is not required) constructs to create a program	
	• Produce programming solution for a given problem.	• Examples: ■ Find the minimum, maximum and average values in a list ■ Search for an item in a list and report the result of the search ■ Find the length of a string of characters ■ Extract required characters from a string of characters ■ Count the number of items, which meet specified criteria in a list ■ Check if the values in a list are in order ■ Use of mathematical formulas

Module / Topic	Revised content	
	Learning Outcomes	**Remarks**
d. Program Testing and Debugging (11 hours) *(Page 30)*	~~● Trace and test algorithms.~~	~~● Students should be able to trace and test an algorithm with manual methods or using some tools, such as Scratch, Microsoft Small Basic, or Raptor. The idea of debugging should also be introduced. Students need to identify boundary cases and generate appropriate test data.~~ ~~● Recall of specific operation/command of the tools is not required.~~
	● Apply data validation check to design appropriate test data.	● Students need to identify boundary cases.
	● Understand and describe types of program errors: syntax, logic and run-time; explain why they occur and debug.	
E. Social Implications		
a. Technological Innovations (3 hours) *(New)*	● Understand the basic concepts of technological innovations and its applications.	● Examples include pattern recognition through artificial intelligence (AI) and data science, 3D printing technologies, augmented reality (AR) and virtual reality (VR). ● Students should have practical experience with these technologies.
b. Health and Ethical Issues (3 hours) *(Page 32)*	~~● Realise that technological innovations can bring major benefits to society if they are used properly, but damage society when they are misused.~~	

Module / Topic	Revised content	
	Learning Outcomes	**Remarks**
	• ~~Discuss change in the nature of work in areas such as work monitoring, telecommuting, working hours, virtual organisations and the removal of national and international barriers to business.~~	
	• Realise the importance of equity of access.	• Students should state the pros and cons of freedom of information on the Internet. They should also know equity issues in terms of the digital divide, gender equity and access for the disabled from local and global perspectives.
	• ~~Be aware of the consequences of indulgence in Internet activities for individuals.~~ Discuss the ethical considerations on the use of ICT.	• ~~Examples of Internet activities are online games, Internet chat and web surfing.~~
c. Intellectual Property (2 hours) (Page 33)	• ~~Know the difference between open source and non-open source software.~~	
	• ~~Debate~~ Understand the benefits and risks of different licensing schemes such as freeware, shareware, open source software and copyrighted software from the perspectives of users and software developers.	

Module / Topic	Revised content	
	Learning Outcomes	**Remarks**
	• Relate acts of possible infringement of copyright in software and Internet piracy.	• Students should discuss the social, legal and economic implications of acts of infringement of copyright. They should also develop the habit of acknowledging the source of information and be aware of the appropriate use of multimedia materials, and the possible crimes and consequences of illegal uses and broadcasting of these materials ~~(e.g. Bit Torrent – BT)~~
d. Threats and Security on the Internet (12 hours) (Page 34-36)	*(All the content in this topic is moved to Core Part Module C or removed)*	

Elective Part (76 hours)

Option / Topic	Revised content	
	Learning Outcomes	**Remarks**
A. Databases		
a. Introduction to Databases (8 hours) (Page 39-40)	(All the content in this topic is removed)	
a. Relational Databases Concepts (6 hours) (Page 40)	● Explain the concept of program-data independence.	
	● Describe the purpose s of rollback.	
b. SQL (18 hours) (Page 41)	● Use SQL to maintain a simple relational database, and manipulate its data or retrieve the required information in at most three tables.	● Skills involved include: ■ modify the structure of the tables ■ add, delete and modify the data in the tables ■ view, sort, and select contents by filtering, and create different views ■ use appropriate operators and expressions such as arithmetic operators and expressions, comparison operators, logical operators and the in, between and like operators. to perform specific operations ■ use simple built-in functions such as aggregate and string functions ■ perform queries on multiple tables, including the use of equi-join, natural join and outer join ■ perform sub-queries (for one sub-level only) ■ export query results to, for example, text, HTML or spreadsheet format

Option / Topic	Revised content	
	Learning Outcomes	**Remarks**
c. *Database Design Methodology (14 hours)* *(Page 41-42)*	● Be aware of and appreciate the importance of a good database design in effective database management.	
	● Describe the needs of the three levels of data abstraction, namely conceptual level, physical level and view level.	
	● Describe the needs and procedures of denormalisation.	
	● Use access rights to achieve data privacy.	
d. *Database Applications, Development and Society (17 hours)* *(Page 43-44)*	*(All the content in this topic is removed)*	

B. Web Application Development	

a.   Network Services and Implementation (14 hours)
      ①   Content captured from Elective Part Option B "Data Communications and Networking"

i. *Basic concepts client-server communication (New)*	● Know the basic concepts of client-server communication.	● This includes the concepts of request and response, including port number in TCP, GET and POST request in HTTP.
	● Know the roles of client and server as two network programs in a network.	
	● Describe common network services. ①	● The common network servers include the Dynamic Host Configuration Protocol (DHCP) server, domain controller, file server, proxy server, web server and database server, gateway, etc.

Option / Topic	Revised content	
	Learning Outcomes	**Remarks**
ii. Basic network implementation (New)	● Set up simple Ethernet and wireless networks. ①	● Examples of simple networks include home networks and ad hoc networks in small exhibitions and special events.
	● Share various resources among the networked computers/stations. ①	● The resources include files, printers and Internet connection, etc.
	● Set folder/ file-sharing permissions, including read, write and execute rights, etc. ①	
	● Set up simple network services.	● Examples of network services include web service and database service.

b. Web Programming and Applications (24 hours)

② Content captured from Elective Part Option C "Multimedia Production and Web Site Development"

(All topics under "Multimedia Production" *(Page 56-58)* are removed)

Option / Topic	Revised content	
i. Web authoring and publishing (Page 60-61)	● ~~Construct simple~~ Edit web pages. ②	● ~~Students should be able to use different features (e.g. links, anchors, lists, tables, frames, Mailto and Fill-out Forms) in constructing the web page. They should also be able to embed multimedia elements in the web page and apply a consistent look and style across a set of web pages.~~ Students should be able to edit HTML code of web pages and apply a consistent look and style across a set of web pages through Cascading Style Sheets (CSS).

Option / Topic	Revised content	
	Learning Outcomes	**Remarks**
	● Publish ~~web site~~ content on web. ②	● ~~Students should know the basics of getting a domain name and web hosting. They should also be able to transfer web pages onto web sites on the Internet.~~ Students should know different ways for publishing content on the web. For example, building a website and posting content through a web-based content management system.
ii. Web programming and applications (Page 61)	● Understand the difference between server-side and client-side technologies. ②	
	● ~~Create interactive menus upon user selection.~~ Create client interface. ②	● ~~Students should be able to create interactive user selection, such as the 2-level interdependent select list, pull-down menu and click-to-expand menu.~~ Students should be able to create client interface in form of web page and application.
	● Demonstrate simple client-side and server-side scripts.	● Examples: ■ Process input data from clients (e.g. calculation on quadratic equation) ■ Simple data validation (e.g. check the range of numeric input) ■ Retrieve and update data from a single-table database ■ Use of Cookies for storing of user information

Option / Topic	Revised content	
	Learning Outcomes	**Remarks**
	● Develop a simple web application.	● Students should be able to integrate client-side and server-side scripts to develop the application. ● Examples: ■ Search engine on restaurants in a shopping mall ■ Homework checklist for a class ■ Personal weight management system
	● Be aware of the new trends in web application development.	
C. Algorithm and Programming		
a. Programming (32 hours)		
i. Problem definition and analysis *(Page 63)*	*(All the content in this topic is removed)*	
i. Design of solution and implementation (28 hours) *(Page 63-64)*	● Select appropriate data types for a solution.	● The data types included are simple data types, structured data types and user-defined data types. Simple data types have been discussed in the Compulsory Part.
	● Represent Review algorithms with flowcharts or block diagrams pseudocode.	

Option / Topic	Revised content	
	Learning Outcomes	**Remarks**
	• Apply algorithms of counting, accumulating, swapping, searching, sorting and merging in writing programs.	• The search algorithms included are linear search and binary search. The sorting algorithms included are bubble sort, insertion sort and ~~merge~~ selection sort. ~~Merging involves only two arrays of data at one time.~~ Students should realise that there are some other faster sorting algorithms, say merge sort and quick sort~~, other than the three stated above~~. Merging involves only two arrays of data at one time.
	• Apply control structures in a solution.	• Sequence, selection and iteration have been introduced in the Compulsory Part. Nested loop is required.
ii. Testing and debugging (4 hours) (Page 65-66)	• Apply both manual methods and software debugging tools to program debugging.	• Use stubs, flags, break points and program traces with test data set for debugging.
	• ~~Design sets of test data for program testing.~~	• ~~Test data for boundary cases has been discussed in the Compulsory Part.~~
v. Documentation (Page 66)	• ~~Develop the habit of documenting the processes of program development.~~	
	• ~~Recognise various documents for documenting a program.~~	• ~~The documents included are algorithm representation, program listings, the sets of test data and user manuals.~~
~~b. Programming Languages (12 hours)~~ *(All the content in this topic is removed)*		
~~c. Systems Development (16 hours)~~ *(All the content in this topic is removed)*		

Option / Topic	Revised content	
	Learning Outcomes	**Remarks**
b. Applications of Programming in Real Life (6 hours)		
(New)	● Use extended programming modules or libraries in writing programs to interact with physical devices.	● Students should be able to use extended modules or libraries for capturing data from sensors (e.g. light sensor and accelerometer) and controlling specific devices (e.g. motor). ● Details of extended modules or libraries are not required.
	● Use event handlers in writing event-driven programs.	● Specific events include user actions (e.g. pressing a button) and sensor values (e.g. the reading from the light sensor is over a defined value). ● Details of event handlers are not required.
	● Construct simple programs on physical devices by using features/components of physical devices like speech recognition and accelerometer.	● Examples include generating a text display by speech recognition, controlling the movement of motors and detecting motion by accelerometer.