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Computer Studies Subject Committee

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# Membership of the HKEAA Certificate of Education Examination Computer Studies Subject Committee

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S4-5 Computer and Information Technology Curriculum  
Joint Working Group (JWG)**

(Since May 2001)

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Secretary: Curriculum Development Officer, Education and Manpower Bureau

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# Preamble

This Curriculum and Assessment Guide is one of the series jointly prepared by the Hong Kong Curriculum Development Council (CDC) and the Hong Kong Examinations and Assessment Authority (HKEAA). It forms the basis for learning and teaching of the subject curriculum as well as for setting public assessment. The issue of this single document on curriculum and assessment aims at conveying a clear message to the public that assessment is an integral part of the school curriculum and at promoting the culture of “assessment for learning” to improve learning and teaching.

The CDC is an advisory body giving recommendations to the Hong Kong Special Administrative Region Government on all matters relating to curriculum development for the school system from kindergarten to sixth form. Its membership includes heads of schools, practising teachers, parents, employers, academics from tertiary institutions, professionals from related fields or related bodies, representatives from the HKEAA and the Vocational Training Council, as well as officers from the Education and Manpower Bureau.

The HKEAA is an independent statutory body responsible for the conduct of the Hong Kong Certificate of Education Examination and the Hong Kong Advanced Level Examination. The governing council of the HKEAA includes members who are mainly drawn from the school sector, tertiary institutions, government bodies, professionals and persons experienced in commerce and industry.

This Curriculum and Assessment Guide is recommended by the Education and Manpower Bureau for use in secondary schools. The subject curriculum developed leads to the appropriate examination provided by the HKEAA. In this connection, the HKEAA has issued a handbook to provide information on the format of the public examination of the subject and the related rules and regulations.

The CDC and HKEAA will keep the subject curriculum under constant review and evaluation in the light of classroom experiences, students’ performance in the public assessment, and the changing needs of society and students. All comments and suggestions on this Curriculum and Assessment Guide should be sent to:

Chief Curriculum Development Officer (Technology Education)  
Curriculum Development Institute  
Education and Manpower Bureau  
5/F, 24 Tin Kwong Road  
Kowloon  
Hong Kong



# I. Aims and Objectives

## Aims

This curriculum aims at providing students the opportunity to

1. develop an understanding of the computer system and information technology;
2. apply concepts and skills related to computer and information technology to solve real life problems;
3. nurture their problem solving, critical thinking and communication skills, as well as their self-learning ability;
4. appraise the impact of computer and information technology; and
5. develop their own values and attitudes regarding the proper use of computer and information technology.

## Objectives

Upon studying the curriculum, students should

1. understand what information processing is and how the common application software can be used as information processing tools to process and present information efficiently and effectively;
2. understand how the different components of a simple computer system work together to perform tasks, as well as how and why computers are connected together to form computer networks;
3. understand the use and development of the Internet and the World Wide Web (WWW) and be able to use them efficiently and effectively;
4. understand basic concepts related to computer programming, learn some of the skills involved in solving problems in a systematic way and be able to apply them;
5. understand some of the issues brought forth by the advances in computer and information technology and be able to act accordingly; and
6. have an in-depth study of one or more of the following elective areas and be able to apply their understanding to solve problems:
  - algorithm and programming
  - organisation of computer
  - data communications and networking
  - multimedia production and web authoring
  - etc...



## II. Curriculum Framework

### Introduction

This curriculum is recommended for use in secondary schools at the secondary 4-5 level. It is a two-year course leading to an examination in the Hong Kong Certificate of Education Examination (HKCEE).

The curriculum will be implemented in schools commencing September 2003. It is intended to replace the curriculum for S4-5 Computer Studies implemented since 1999 and the curriculum for S4-5 Information Technology implemented since 2000.

### Organisation of the Curriculum

To cater for diverse learning needs, the curriculum is organised into one core module and four elective modules as shown in the diagram on Page 8. Students taking the subject are requested to take the core module and *one* elective module that best meets their own interest and ability.

The Core Module, which comprises comparatively more stable elements of the subject, aims to provide students the essential fundamental knowledge of the subject and the concepts and skills related to it. It is anticipated that students will spend 80 hours in total to complete studying the contents. Students who complete the Core Module can build up a strong foundation to further their study in some specialised areas of the subject.

The Core Module includes the following five topics. The number and contents of the topics will be revised in the light of curriculum or technological changes.

- (i) Information Processing and Presentation
- (ii) Computer Systems and Networking
- (iii) Internet and its Applications
- (iv) Basic Programming Concepts
- (v) Social Implications of Computer and Information Technology

The Elective Modules are for students who wish to excel in a specialised area of their own choice. Four Elective Modules are proposed at this stage. It is anticipated that students will spend 30 hours in studying each module.

- (A) Algorithm and Programming
- (B) Organisation of Computer
- (C) Data Communications and Networking
- (D) Multimedia Production and Web Authoring

The number of elective modules provided by each school is to be determined by the school concerned, taking into consideration students' interests, teachers' expertise and the resources available.

As a means for students to integrate and apply the knowledge and skills acquired, as well as to demonstrate the positive values developed, each student is required to complete a piece of coursework individually during his or her course of study. The focus of the coursework will be based on the elective module chosen by the student.

10 hours of curriculum time has been allocated for the coursework. The time reserved is for teachers to give advice and guidance to students regarding their pieces of work. It is essential that each piece of coursework is the demonstrated effort of the individual student. The role of the teacher is essentially that of a facilitator. Further elaboration on the coursework can be found on the documents issued by the HKEAA and the chapter on *Assessment*. Students should note that the coursework is a mandatory requirement of the HKCEE and the amount of effort spent on coursework should not be limited to 10 hours only.

A summary of the organisation of the curriculum and the distribution of the time allocation are shown in the figures on Page 8 and 9. Details of the curriculum are found on Page 12 to 37.

## **Contents and Structure of the Modules**

To illustrate clearly the kind of learning to be achieved, each module is framed firstly in terms of the learning outcomes expected of students. There is then a list of the topics/sub-topics that can be explored, including ideas about the flow of the contents. For the elective modules, as an in-depth study of the specialised area is required, more details related to knowledge and skills are given.

The expected learning outcomes describe what students should understand, be able to do and be aware of, as they go through the course. Schools and teachers can exercise their discretion in choosing the appropriate contents as vehicles for organising the learning activities for their students to achieve the outcomes.

In connection with this, no specific software has been mentioned in the learning of the modules. Also, in the elective module “Algorithm and Programming”, schools are allowed to choose their own programming language that meets the curriculum requirements, according to the strengths of their own teachers and the learning needs of their students.

As regards the assessment of students’ programming skills in the public examination for the “Algorithm and Programming” module, students will be assessed as far as possible in their understanding of the algorithm involved, rather than in the syntax of a particular programming language. If there is a need for students to respond in the public examination by writing code segments, a programming language for schools and students will be recommended in advance through documents issued by the CDC and HKEAA (see Appendix). The revision of the programming language recommended will not be frequent. Teachers and students should refer to the latest examination handbook and other relevant documents for information.

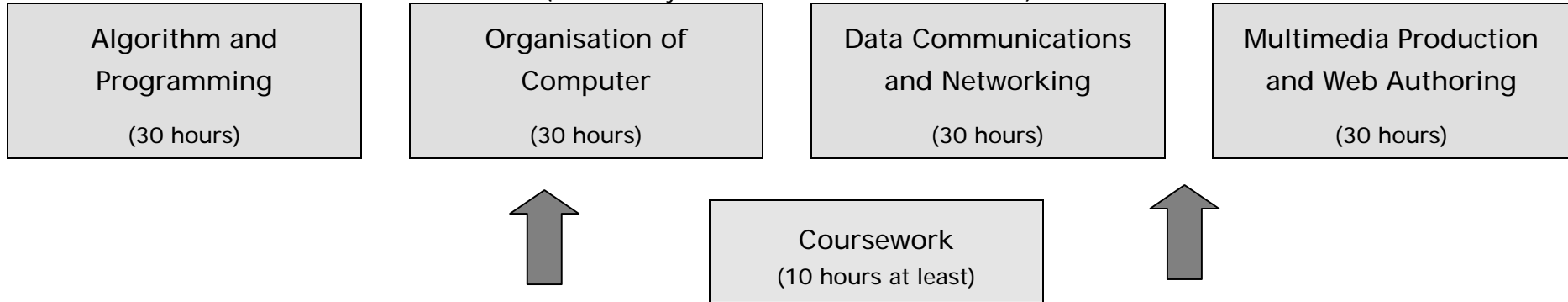
To facilitate student learning, teachers are advised to plan learning activities for both the Core Module and the Elective Module chosen by their students together, optimising the curriculum time and the provision of an appropriate learning sequence.

Further elaboration on the learning and teaching of the curriculum can be found in the chapter on *Learning and Teaching*. Additional information on assessment will be found in the chapter on *Assessment*.

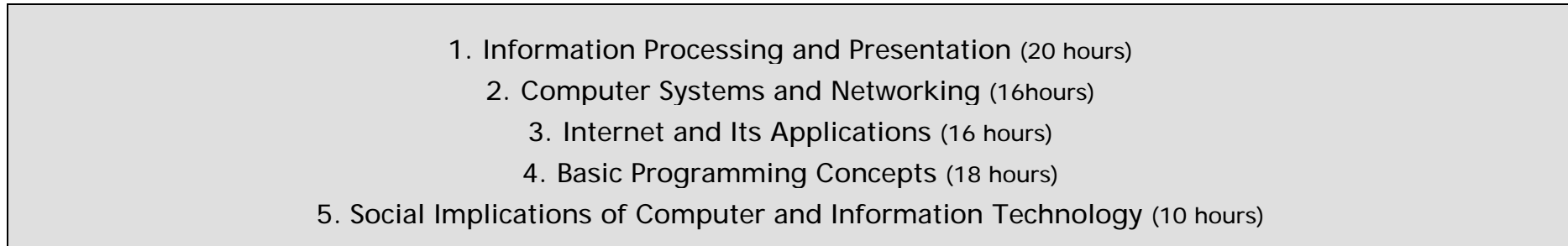
## Outline of the S4-5 Computer and Information Technology Curriculum

### Elective Modules (30 hours)

(Choose any one from four elective modules)



### Core Module (80 hours)



Grant total: 120 hours

## Suggested Time Allocation

For each module/topic, the number of hours required is estimated and shown below:

| Module/Topic   | No. of hours allocated |
|--|------------------------|
| <b>I. Core Module :</b>                                    | <b>80</b>              |
| Information Processing and Presentation                    | 20                     |
| Computer Systems and Networking                            | 16                     |
| Internet and its Application                               | 16                     |
| Basic Programming Concepts                                 | 18                     |
| Social Implications of Computer and Information Technology | 10                     |
| <b>II. Elective Module :</b>                               | <b>30</b>              |
| Algorithm and Programming                                  | 30                     |
| Organisation of Computer                                   | 30                     |
| Data Communications and Networking                         | 30                     |
| Multimedia Production and Web Authoring                    | 30                     |
| <b>III. Coursework :</b>                                   | <b>10</b>              |

**Total Curriculum Time :**

**120 hours**

The topics are not meant to be taught in isolation. A good integration of the learning experiences in the different areas will enhance the effectiveness of the learning process.

Schools may allocate 4 periods per week or 5 periods per 6-day cycle (each period of 40 minutes) for this curriculum. Alternatively they may use a block time-table for teaching and learning the curriculum. In general, the Core Module can be covered in the first year while the second year can be used for the specialised study. This is however only one of the ways of organising the learning and teaching. Schools may consider integrating the learning and teaching of the Core Module and the Elective Module chosen for a particular group of students to optimise the use of the curriculum time. The most crucial considerations are the ability of the students to take up the contents and the possibility of organising appropriate learning activities within the given time.



## Details of the Curriculum

Details of the curriculum are given in the following pages. The contents of each topic of the Core Module is given by the corresponding opposite pages that follow. The contents of each subsequent Elective Module is given by a leading page that outlines the expected learning outcomes and the 2-3 pages showing the details that go after the leading page.



## 1. Information Processing and Presentation

### Overall Expectations



Students are expected to have a basic understanding of what information processing is and how the common application software can be used as an information processing tool to process and present information efficiently and effectively. Upon completing the topic, students should also develop a concern about the reliability and objectivity of information and be aware that these issues are sometimes not resolved even with the sophisticated information processing tools.

Students should:

- Be aware of the different applications of information technology in our everyday life;
- Appreciate how the advances in information technology fosters the emergence and development of the Information Age, and vice versa;
- Understand the difference between information and data, as well as the basic concepts underlying the generation of useful information from raw data;
- Understand the way data are represented inside a computer;
- Understand the meaning of fields, records, tables and databases in organising related data into meaningful information;
- Be able to select the appropriate tools to process the different types of information;
- Be able to integrate the use of common application software to process and present information; and
- Understand and apply concepts for effective communication in their presentations.

The time allocation for the topic is about 20 hours.

Students are expected to have the knowledge and skills pertaining to Stage III of the Information Technology Learning Targets in learning this topic.



Students' study of the topic can include the following sub-topic areas:

The Information Age

- Applications of information technology in our everyday life
- Information technology and the Information Age

Basic concepts underlying the generation of useful information from raw data

- Differences between data and information
- Data collection and data preparation
- Sources of error, data validity and data control
- Processing data, including searching, sorting, merging
- Processing information, including reorganisation, conversion, communication and transmission
- Batch processing versus real-time processing

Representation of data inside a computer

- Binary, denary and hexadecimal numbers
- Bit and byte
- American Standard Code for Information Interchange (ASCII)
- Representation of Chinese characters

Integrated use of common application software

Criteria for effective presentation of information

- Different ways to present information
- Meaning of multimedia and using multimedia elements in a presentation
- Merits of using multimedia elements
- Planning for a successful presentation
- Selecting appropriate information for presentation
- Organising the relevant information
- Introducing interactive elements
- Conducting an effective presentation

*Note: The above listing represents only one way of organising the relevant contents and is by no means the only way to deliver the curriculum. Teachers should plan and organise their teaching according to the students' needs, their pre-requisite knowledge, and how the topic is related to the other content areas. The study of the topic should be related to other topics in the core module.*

As students may have different IT skills when taking the course, teachers should also adjust the teaching time accordingly.

Students are expected to have sufficient exposure to a variety of learning activities, such as designing a survey form for data input, preparing a slide show that runs automatically, etc., for them to generate the required concepts, instead of teachers expounding the underlying theories only.

Students' knowledge on multimedia in this topic should be confined to using these elements and constructing simple ones, instead of constructing sophisticated ones from scratch.



## 2. Computer Systems and Networking

### Overall Expectations



Students are expected to have a basic understanding of how the different components of a simple computer system, including its hardware and software, work together to perform tasks. Their knowledge of the computer system should be extended to a general awareness of how and why computers are connected to form a network at home, in school and in the workplace. Students should have exposure to a variety of operating systems and be aware of the major trends in the development of hardware and software.

Students should:

- Understand the basic components of a computer system;
- Understand the functions and properties of the major hardware, including the major peripheral devices, and be able to select the appropriate hardware to meet specific purposes, based upon an understanding of these functions and properties;
- Understand the general characteristics of the operating system;
- Understand why computers are connected nowadays to form networks;
- Understand how computers can be connected locally to form a Local Area Network (LAN) and over a long distance to form a Wide Area Network (WAN);
- Be able to use and describe the common services available in a networked environment; and
- Develop the habits of operating a computer considerately, managing its files and resources regularly, and be able to use the common backup, compression, system protection and file protection utilities to maintain system and file integrity.

The time allocation for the topic is about 16 hours.



Students' study of the topic can include the following sub-topic areas:

Typical hardware components

- Central Processing Unit (CPU)
- Bus system
- Read Only Memory (ROM) and Random Access Memory (RAM)
- Input / Output (I/O) devices
- Secondary storage devices
- Interface cards

Typical properties of hardware

- Computational power
- Storage capacity
- Data transfer rate
- Other appropriate properties

Selecting the appropriate hardware for specific purposes

System software and application software

- Basic ideas about system software, application software and driver programs
- Basic functions of the operating system
- Some common operating systems and their differences, including operating systems in other electronic devices such as Personal Digital Assistants (PDAs)
- Cross-platform issues

Basic concepts of a computer network

- The need for a computer network at home, in school and in the workplace
- A LAN versus a WAN
- Basic requirements for connecting to a computer network
- Common services available in a networked environment

*Note: The above listing represents only one way of organising the relevant contents and is by no means the only way to deliver the curriculum. Teachers should plan and organise their teaching according to the students' needs, their pre-requisite knowledge, and how the topic is related to the other content areas. The study of the topic should be related to other topics in the core module.*



### 3. Internet and its Applications

#### Overall Expectations



Students are expected to have a basic understanding of the use and development of the Internet and the World Wide Web (WWW).

Students should:

- Understand the concepts underlying the development of the Internet and the WWW;
- Be able to participate in Internet activities, including searching for information using search engines, browsing information, sending and receiving e-mails, uploading and downloading files;
- Be aware of the kinds of personal, social or commercial activities that are available on the Internet, including e-Commerce, e-Learning and public services accessible through the Internet;
- Be aware of the risks when engaging in Internet activities, and be able to apply appropriate measures to safeguard themselves in undertaking such activities;
- Be aware of the impact of the Internet technology on our everyday life;
- Be able to connect to the Internet and be aware of the technologies underlying the operation of the Internet, including the roles of the service providers, the types of connection and access, the use of protocols such as Transmission Control Protocol/Internet Protocol (TCP/IP), the use of domain names and domain name servers; and
- Be able to construct simple web pages and apply the knowledge and skills of hyperlinks and multimedia in constructing web pages.

The time allocation for the topic is about 16 hours.

Students should also be able to apply concepts on effective communication in the design and construction of web pages.



Students' study of the topic can include the following sub-topic areas:

Internet and the Internet technology

- Historical development of the Internet and the WWW
- Making connections: hardware requirements, types of connection, types of access
- TCP/IP as an example of communication protocols
- IP address, domain names and domain name servers

Internet activities

- Search engines and skills in searching for information on the Internet
- Web browsing, e-mail, file transfer, video-conferencing
- e-Commerce: business models and impacts on our everyday life
- e-Learning and impacts on our everyday life
- Public services accessible through the Internet
- Issues arising from unlawful or unethical Internet activities

Web authoring

- Markup language as a means to address cross-platform issues
- A brief introduction to Hypertext Markup Language (HTML)
- Using a web authoring tool to construct simple web pages
- Incorporating multimedia elements
- Incorporating hyperlinks

*Note: The above listing represents only one way of organising the relevant contents and is by no means the only way to deliver the curriculum. Teachers should plan and organise their teaching according to the students' needs, their pre-requisite knowledge, and how the topic is related to the other content areas. The study of the topic should be related to other topics in the core module.*

Students should be able to apply their knowledge on multimedia as described in the first topic in constructing simple web pages.



## 4. Basic Programming Concepts

### Overall Expectations



Students are expected to have a basic understanding of computer programming and learn the skills and methods involved in solving problems in a systematic way. Students are expected to learn the logic behind computer programs through short program segments or similar means, instead of learning the syntax of a particular programming language.

Students should:

- Understand the meaning of problem solving and appreciate the use of a systematic approach to solve problems;
- Be able to apply concepts of systematic problem solving to real life problems;
- Be aware of a brief historical development of the programming languages and understand the differences between a high level programming language and a low level programming language;
- Understand the differences among the different translators: the compiler, the interpreter and the assembler;
- Understand the meaning of an algorithm and a program flowchart;
- Be able to identify the objectives of an algorithm from an examination of its program flowchart;
- Appreciate that there are different ways of solving the same problem, and be able to make simple comparison among them;
- Be able to trace the logical flow, identify the values of variables during execution and debug logical errors in segments of a program flowchart, or other means of realising the solution of a problem;
- Be able to recognise the basic constructs of a computer program; and
- Appreciate the importance of good programming habits, such as clear documentation, use of meaningful variables, use of the modular approach, etc.

The time allocation for the topic is about 18 hours.



Students' study of the topic can include the following sub-topic areas:

Problem solving procedures

- The need for a systematic way of solving problems
- Problem solving procedures: problem identification, problem analysis, designing an algorithm, developing a solution, debugging and testing, documentation
- Real life application of the problem solving procedures and some practical considerations
- Using a program flowchart to realise the algorithm
- Different ways to solve the same problem and their brief comparison

Programming languages

- Roles of a programming language in the realisation of an algorithm
- Historical development of programming languages
- High level and low level programming languages: their needs, characteristics and examples
- Functions of the different translators: compiler, interpreter and assembler

Programming concepts in using a high level programming language

- Input, output, assignment of values to variables
- Using constructs such as branching and iteration structures
- Tracing program flow: identifying values of variables and debugging logical errors

*Note: The above listing represents only one way of organising the relevant contents and is by no means the only way to deliver the curriculum. Teachers should plan and organise their teaching according to the students' needs, their pre-requisite knowledge, and how the topic is related to the other content areas. The study of the topic should be related to other topics in the core module.*

As the topic aims to encourage logical and analytical thinking, teachers are encouraged to use samples of program segments whose length and complexity are appropriate to their students' cognitive level. Students' learning of the concepts should focus on their ability to apply appropriate logic and design in the construction of program flowcharts or other means of realising the solution, and whether the proposals can meet given requirements.



## 5. Social Implications of Computer and Information Technology

### Overall Expectations



Students are expected to have a basic understanding of issues brought forth by the advances in computer and information technology. The issues range from those that are legal or ethical in nature, to those that are related to health, the environment or a change in life style.

Students should:

- Understand the legal and ethical issues related to the use of computer and information technology;
- Understand the health and environmental issues related to the advances in computer and information technology;
- Understand how computer and information technology has changed their life styles;
- Appreciate the need to use computer and information technology legally, ethically and sensibly;
- Develop a care and concern towards the proper use of computer and information technology, as well as a positive feeling towards future developments, including the application of these future developments.

The time allocation for the topic is about 10 hours.



Students' study of the topic can include the following sub-topic areas:

Legal and ethical issues

- Intellectual Property Right (IPR), including copyright issues and software licensing
- Data privacy
- Unauthorised access, including hacking and cracking
- Indecent and deceitful materials
- Spam, virus and other related issues

Issues related to health, environment or a change in life style

- Occupational safety: ergonomic and stress issues
- Environmental issues of computer equipment
- Turnover rate of computer equipment
- The cashless society
- Digital certification
- The knowledge-based society
- Globalisation

Impacts of upcoming technologies, such as use of broader bandwidth, mobile technology, smart home technology, etc.

Ways to protect ourselves: from property loss; from being hacked, offended, injured or impersonated

*Note: The above listing represents only one way of organising the relevant contents and is by no means the only way to deliver the curriculum. Teachers should plan and organise their teaching according to the students' needs, their pre-requisite knowledge, and how the topic is related to the other content areas. The study of the topic should be related to other topics in the core module.*

Students should be given sufficient opportunities to discuss and debate the issues for them to conceptualise, reflect and refine ideas, to develop their critical thinking and communication skills, as well as formulating their own personal judgements.

Details of the Elective Modules are given in the following order:

- (A) Algorithm and Programming
- (B) Organisation of Computer
- (C) Data Communications and Networking
- (D) Multimedia Production and Web Authoring

## Elective Module (A)

Algorithm and  
Programming

Organisation  
of Computer

Data Communications  
and Networking

Multimedia Production  
and Web Authoring

### Algorithm and Programming

The elective **Algorithm and Programming** is built upon the topic '**Basic Programming Concepts**' in the core module. Students are expected to have further understanding of computer programming. They should be able to design and develop computer programs on their own for solving problems. They should be given opportunities to improve their high order thinking skills, including logical thinking and problem solving skills, and apply them in different contexts. Students should be able to write programs for different purposes, like solving mathematical problems, designing games, computer simulation, and business applications, etc. Students may use any appropriate programming language to realise the programming concepts and techniques discussed in this module.

#### Overall Expectations

In summary, students should be able to:

- Define and analyse problems;
- Formulate algorithms for solving problems;
- Apply programming concepts and techniques to realise formulated algorithms in computer programs;
- Design and develop computer programs;
- Develop good programming styles, including modularity of programs, use of meaningful variable identifiers, indentation, spacing, etc.;
- Debug a computer program to ensure that the program can execute as expected;
- Develop program documentation to summarise the design and to improve the readability of a computer program; and
- Understand the design and algorithm of computer programs developed by others, through tracing, reading documentation, intuition, or any other appropriate means, to develop the skills to provide maintenance and support.

The time allocation for the elective is about 30 hours.

## Details of the Elective

The elective *Algorithm and Programming* comprises three topics, namely '*Design Techniques*', '*Program Development*' and '*Algorithm and Data Structure*'. Further information on the three topics is summarised as follows:

| Topics   | Remarks   |
|--|---|
| <b>A. Design Techniques</b>  |   |
| <ul style="list-style-type: none"><li>Program development procedures: problem definition, problem analysis, algorithm design, program coding, program debugging/testing, and program documentation</li></ul> | <ul style="list-style-type: none"><li>Students should understand the procedures commonly used in developing programs. They should realise that sometimes the procedures may not be applied in sequence. The procedures may sometimes require iteration, too.</li><li>Students should be able to identify the necessary inputs and expected outputs when analysing a problem.</li><li>Students should understand the concepts of modularity and stepwise refinement as examples of problem analysis techniques.</li><li>Students should realise that program documentation (e.g. the titles, lists and definitions of variables, test data, sample output, internal documentation, etc.) is intended to make the program comprehensible. They should be able to read the documentation and develop the habit of documenting their programs.</li></ul>  |
| <ul style="list-style-type: none"><li>Problem solving approaches</li></ul>   | <ul style="list-style-type: none"><li>Students should understand the meaning of the top-down, bottom-up, and trial-and-error approaches. They should be able to apply these problem solving approaches in developing programs. They should realise that the top-down approach is often emphasised. However, other approaches can be used as well.</li></ul>   |
| <ul style="list-style-type: none"><li>Selection of programming languages</li></ul>   | <ul style="list-style-type: none"><li>Students should be aware that there exist different types of programming paradigm, such as imperative programming, object-oriented programming, logic programming, etc.</li><li>Students should also be aware that different programming languages are designed to satisfy different specific purposes.</li></ul>   |
| <b>B. Program Development</b>  |   |
| <ul style="list-style-type: none"><li>Writing programs</li></ul>   | <ul style="list-style-type: none"><li>Schools should use a programming language that best meets the interest and ability of students in teaching them how to write programs. The learning and teaching should focus on how an algorithm can be realised using the language used.</li><li>The assessment of the students' coursework in school should be based on the language chosen. For the assessment of students' programming skills in the public examination, students should refer to relevant documents published by the CDI and HKEAA.</li><li>Students should understand the meaning of the basic data types (integer, real number, character, string, and Boolean) as well as the structured data types (one-dimensional array and two-dimensional array). They should understand why there are different types of data and how these data are manipulated in a program.</li></ul> |

| Topics  | Remarks   |
|---|---|
| <ul style="list-style-type: none"> <li>Program development tools and program execution</li> </ul> | <ul style="list-style-type: none"> <li>Students should be able to use expressions of arithmetic operations, string operations, Boolean operations, built-in functions, assignment statements, input statements, output statements, etc. to manipulate data.</li> <li>Students should be able to use subprograms and programming constructs, such as selection structures, counter-controlled loops, conditional loops, nested loops, etc., to develop programs.</li> <li>Students should be able to write file handling statements to manipulate text files.</li> <li>Students should have the experience of using program development tools to develop their programs. They should use the various features provided by the tools to load, save, edit, compile, execute, print and debug programs.</li> <li>Students should be able to use library functions.</li> </ul> |
| <ul style="list-style-type: none"> <li>Debugging and Testing</li> </ul>                           | <ul style="list-style-type: none"> <li>Students should be able to debug programs with manual methods or software debugging tools.</li> <li>Students should be able to identify and correct syntax, logical, and runtime errors in programs, and test programs using a full range of test cases.</li> </ul>  |

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### *C. Algorithm and Data Structure*

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>Understanding and applying the following algorithms in programming: counting, accumulating, swapping, sorting, searching, merging two sorted arrays</li> </ul> | <ul style="list-style-type: none"> <li>Students should be able to formulate algorithms for problems and realise algorithms into computer programs.</li> <li>Students should realise that there can be different algorithms for the same problem and should be able to make simple comparison among them.</li> </ul> |
| <ul style="list-style-type: none"> <li>Formulation of algorithms according to the specification of a problem and the input/output requirements</li> </ul>   | <ul style="list-style-type: none"> <li>Students should understand that data can be organised conceptually in the form of different structures. They should be able to select and use the appropriate data structure to store and represent data in a program.</li> </ul>  |
| <ul style="list-style-type: none"> <li>Features of an array, a queue, a stack and a linked list</li> </ul>  |   |
-



## Elective Module (B)

Algorithm and  
Programming

Organisation  
of Computer

Data Communications  
and Networking

Multimedia Production  
and Web Authoring

### Organisation of Computer

The elective **Organisation of Computer** is built upon the topic '**Computer Systems and Networking**' in the core module. Students are expected to have further understanding of a computer system, its hardware, its configuration, ways to optimise its performance, and some troubleshooting techniques. They should also be aware of the characteristics of the different personal computers and the operating systems they can choose.

#### Overall Expectations

In summary, students should be able to:

- Compare and contrast the different families of personal computers available in the market and the operating systems they can choose;
- Explain briefly the factors that affect the performance of the CPU;
- Identify and explain the use of the functional units of the main board and the different add-on cards;
- Explain basic concepts underlying the operation of a personal computer, such as the meaning of an instruction set, the roles and functions of the Arithmetic and Logic Unit (ALU), Control Unit (CU), registers, Direct Memory Access (DMA), Basic Input-Output System (BIOS), cache and virtual memory, etc.;
- Identify the different bus systems in a personal computer and explain the differences among them;
- Identify the different ports and interfaces for connecting with peripheral units and explain their differences;
- Describe briefly the steps involved in the boot process and how the operation and performance of a personal computer can be fine-tuned by modifying its configuration;
- Make suggestions on the hardware and configuration of a personal computer for meeting particular purposes; and
- Develop basic skills in troubleshooting, performance enhancement and daily maintenance of personal computers.

The time allocation for the elective is about 30 hours.

## Details of the Elective

The elective *Organisation of Computer* comprises four topics, namely '*Overview of Personal Computers*', '*CPU, Main Board, Memory and I/O Interfaces*', '*System Configuration*' as well as '*Basic Computer Maintenance and Troubleshooting Techniques*'. Further information on the topics is summarised as follows:

| Topics  | Remarks  |
|---|--|
| <b>A. Overview of Personal Computers</b>  |  |
| <ul style="list-style-type: none"><li>Evolution of personal computers</li></ul>                 | <ul style="list-style-type: none"><li>Students should be able to give a brief account of the history of personal computers and explain how it is related to the development of computer technology.</li></ul>  |
| <ul style="list-style-type: none"><li>Families of personal computers</li></ul>                  | <ul style="list-style-type: none"><li>Students should be aware of the existence of the different families of personal computers and be able to describe the major differences among them.</li></ul>  |
| <b>B. CPU, Main Board, Memory and I/O Interfaces</b>  |  |
| <ul style="list-style-type: none"><li>Performance of the CPU and the instruction sets</li></ul> | <ul style="list-style-type: none"><li>Student should know that the performance of the CPU is affected by factors such as the integrated circuit technology, clock rate, word size, amount of the cache, complexity of the instruction set, advanced technology such as pipelining and parallel processing, etc.</li><li>Students should be aware of the roles and functions of key components such as the ALU, CU, and registers.</li></ul>  |
| <ul style="list-style-type: none"><li>The main board</li></ul>                                  | <ul style="list-style-type: none"><li>Students should be aware of the typical layout of the main board as well as the location and form of the functional units, such as the CPU socket/slot, chipsets, memory and expansion slots, etc.</li><li>Students should be aware that some functional units have now been built into the main board, such as the audio interface, the graphics interface and the network interface, but the majority of the system expansion and upgrading are performed through various add-on interface adapters.</li></ul> |
| <ul style="list-style-type: none"><li>RAM, ROM, BIOS, cache and virtual memory</li></ul>        | <ul style="list-style-type: none"><li>Students should have a basic understanding of the roles and functions of the different memory units. They should also know the relationship between bits, bytes, kilobytes (KB), megabytes (MB), gigabytes (GB) and terabytes (TB).</li></ul>  |
| <ul style="list-style-type: none"><li>Buses, I/O Interfaces and peripheral handling</li></ul>   | <ul style="list-style-type: none"><li>Students should know that there are different buses for connecting the different parts of a personal computer, and different ports for connecting different peripheral devices. Students should know the characteristics of these buses and ports.</li><li>Students should be aware of the roles and functions of DMA and interrupts in handling peripherals.</li></ul>  |

| Topics   | Remarks   |
|--|---|
| <ul style="list-style-type: none"> <li>Emergence of industrial standards</li> </ul>                                    | <ul style="list-style-type: none"> <li>Students should know that there are industrial standards emerged for interfacing different parts of the personal computers. They should be aware of some of the examples and should know how these standards are usually set. They should be given sufficient opportunities to discuss the pros and cons of having standards.</li> </ul>   |
| <i>C. System Configuration</i>   |   |
| <ul style="list-style-type: none"> <li>Configuring the BIOS</li> </ul>   | <ul style="list-style-type: none"> <li>Students should be aware of the major steps involved in a boot process and the purposes of each step.</li> <li>Students should be aware of the major functions of the BIOS and be able to change its settings to alter the system configuration.</li> </ul>  |
| <ul style="list-style-type: none"> <li>System software: the operating systems, device drivers and utilities</li> </ul> | <ul style="list-style-type: none"> <li>Students should understand the characteristics of the different common operating systems and be able to select the appropriate one to meet particular purposes.</li> <li>Students should understand the roles and functions of device drivers and be able to install them.</li> <li>Students should have the experience of working with different utility software, such as those for protecting the computer from virus infection, those for providing firewall services, the disk repair/recovery utilities, the performance enhancement software, etc.</li> </ul> |
| <i>D. Basic Computer Maintenance and Troubleshooting Techniques</i>  |   |
| <ul style="list-style-type: none"> <li>Assembling your own computer system</li> </ul>                                  | <ul style="list-style-type: none"> <li>Students should have the hands-on experience of assembling a personal computer, including the installation of the operating system and the other appropriate hardware and software to meet specific performance requirements.</li> <li>Students should be aware of the compatibility issues in selecting hardware components.</li> </ul>   |
| <ul style="list-style-type: none"> <li>Basic computer maintenance</li> </ul>   | <ul style="list-style-type: none"> <li>Students should develop the concept of symptom, cause and solution, and be aware of the <i>hazards</i> (e.g. the high voltage and the laser beam) associated with the use of some devices. They should be able to implement safety measures to safeguard themselves in assembling computers and in performing computer maintenance.</li> <li>Students should develop the skills to track system performance and be able to analyse under-performance to make recommendations for improvement.</li> </ul>   |
| <ul style="list-style-type: none"> <li>Basic troubleshooting techniques</li> </ul>                                     | <ul style="list-style-type: none"> <li>Students should have the experience of performing troubleshooting and analysing problems associated with the operation of a personal computer.</li> </ul>  |



## Elective Module (C)

Algorithm and  
Programming

Organisation  
of Computer

Data Communications  
and Networking

Multimedia Production  
and Web Authoring

### Data Communications and Networking

The elective **Data Communications and Networking** is built upon the topics '**Computer Systems and Networking**' as well as '**Internet and Its Applications**' in the core module. Students opting for this module are expected to have further understanding of data communication networks, how they work, the advantages of having a networked environment, applications and other potential use of a computer network, etc. This module, in particular, will explore the common features between Internet applications and the applications found in local area networks.

#### Overall Expectations

In summary, students should be able to:

- Identify different types of communication networks and the major components involved;
- Understand the basic principles underlying how communication networks work and the importance of establishing protocols;
- Understand the concepts and technology behind the Internet, identify various useful tools and services available on the Internet, and be aware of the rapid growth of e-Commerce;
- Explain the advantages of establishing a Local Area Network (LAN);
- Identify the components, understand the standards and topology used, and explore the performance of a LAN, using Ethernet as an example;
- Carry out simple network design activities and identify major issues concerning the management and security of a networked environment; and
- Suggest measures to manage and to improve the performance and security of a network.

The time allocation for the elective is about 30 hours.

## Details of the Elective

The elective *Data Communications and Networking* comprises four topics, namely '*An Overview of Data Communications and Networking*', '*The Internet*', '*Local Area Networks*' and '*Network Design, Management and Security*'. Further information on the four topics is summarised as follows:

| Topics  | Remarks   |
|---|---|
| <b>A. An Overview of Data Communications and Networking</b>   |   |
| <ul style="list-style-type: none"><li>• Components of a network and types of communication links</li></ul>  | <ul style="list-style-type: none"><li>• Students should understand the basic principles underpinning data communications and networking. They should be able to identify, explain and provide examples of the components (server/host, client, and circuit) of a network. They should be able to describe and explain the characteristics of the different types of communication links, such as modem dial-up, leased line, Integrated Services Digital Network (ISDN), etc.</li></ul> |
| <ul style="list-style-type: none"><li>• Communication protocols, mode of transmission and bandwidth</li></ul>   | <ul style="list-style-type: none"><li>• Students should know the needs for communication protocols, and be aware of the different modes of data transmission, such as serial and parallel, simplex and duplex, multiplexing, etc.</li></ul>   |
| <ul style="list-style-type: none"><li>• Types of networks</li></ul>   | <ul style="list-style-type: none"><li>• Students should be able to describe the characteristics of the different types of networks, including the Local Area Networks (LAN), Metropolitan Area Network (MAN) and Wide Area Network (WAN).</li></ul>   |
| <ul style="list-style-type: none"><li>• Future trends of data communications &amp; networking</li></ul>   | <ul style="list-style-type: none"><li>• Students should have sufficient discussion on the future trends of data communications and networking.</li></ul>  |
| <b>B. The Internet</b>  |   |
| <ul style="list-style-type: none"><li>• Development of the Internet, Internet addresses &amp; Domain Name Systems (DNS), the basic principles of Transmission Control Protocol / Internet Protocol (TCP/IP)</li></ul> | <ul style="list-style-type: none"><li>• Students should be able to give a brief account of the development of the Internet, explain the principles of DNS, what is TCP/IP and how it works.</li></ul>   |
| <ul style="list-style-type: none"><li>• Tools and services available on the Internet</li></ul>  | <ul style="list-style-type: none"><li>• Students should be able to give examples of common applications available on the Internet (e.g. WWW, electronic mail, video conferencing, file transfer, telnet, etc.) and describe the working principles behind.</li></ul>  |
| <ul style="list-style-type: none"><li>• Business on the Internet</li></ul>  | <ul style="list-style-type: none"><li>• Students should be aware of the common e-Commerce models and be able to describe the general principles underlying the operation of electronic stores, electronic marketing, customer service sites, information and entertainment provision, etc.</li></ul>  |

| Topics  | Remarks   |
|---|---|
| <b><i>C. Local Area Networks</i></b>  |   |
| <ul style="list-style-type: none"> <li>Basic concepts of a LAN</li> </ul>   | <ul style="list-style-type: none"> <li>Students should be able to describe and explain the advantages of using a LAN. They should understand the differences between a client-server LAN with a peer-to-peer LAN.</li> <li>Students should understand the basic network topology such as star, ring and bus.</li> </ul>   |
| <ul style="list-style-type: none"> <li>LAN components</li> </ul>  | <ul style="list-style-type: none"> <li>Students should be able to describe the name and functions of the various components comprising a LAN, including the network interface cards (NICs), cables, hubs &amp; switches, network operating system, etc.</li> </ul>  |
| <ul style="list-style-type: none"> <li>Ethernet as a LAN example</li> </ul>   | <ul style="list-style-type: none"> <li>Students should be able to describe the technology, characteristics and development of the Ethernet LAN.</li> </ul>  |
| <ul style="list-style-type: none"> <li>LAN performance</li> </ul>   | <ul style="list-style-type: none"> <li>Students should know that the performance of a LAN is affected by factors such as the server performance, circuit capacity, network traffic, technology adopted and the networking operating system used. They should be given opportunities to explore issues related to the performance of a LAN and to propose ways to improve it.</li> </ul> |
| <ul style="list-style-type: none"> <li>Connecting LANs to the Web</li> </ul>  | <ul style="list-style-type: none"> <li>Students should be aware of the different ways and components necessary for connecting a LAN to the WWW.</li> </ul>  |
| <ul style="list-style-type: none"> <li>Recent development of LAN technologies</li> </ul>  |   |
| <b><i>D. Network Design, Management &amp; Security</i></b>  |   |
| <ul style="list-style-type: none"> <li>Need analysis, design and cost assessment, network configuration, documentation</li> </ul> | <ul style="list-style-type: none"> <li>Students should be able to design a simple LAN for satisfying a particular purpose, justify the technology and configuration chosen, prepare a simple schematic diagram of a network and write up documents to record the specifications of the network.</li> </ul>  |
| <ul style="list-style-type: none"> <li>Network monitoring and troubleshooting</li> </ul>  | <ul style="list-style-type: none"> <li>Students should have the experience of performing troubleshooting and analysing problems associated with the use of a networked environment.</li> </ul>  |
| <ul style="list-style-type: none"> <li>End-user support and training issues</li> </ul>  | <ul style="list-style-type: none"> <li>Students should be given sufficient opportunities to discuss issues related to support and training.</li> </ul>  |
| <ul style="list-style-type: none"> <li>Type of security threats, network control, preventing unauthorised access</li> </ul>       | <ul style="list-style-type: none"> <li>Students should be given sufficient opportunities to discuss issues related to network control, security, and prevention of unauthorised access.</li> </ul>  |



## Elective Module (D)

Algorithm and  
Programming

Organisation  
of Computer

Data Communications  
and Networking

Multimedia  
Production and Web  
Authoring

### Multimedia Production and Web Authoring

The elective **Multimedia Production and Web Authoring** is built upon a number of topics in the core module, including '**Information Processing and Presentation**', '**Computer Systems and Networking**' as well as '**Internet and its Applications**'. Students are expected to have further understanding of multimedia production and web authoring. They should develop the required concepts through structured tasks, as in real life situation the production is not meant to be piecemeal and it is essential for the designer or developer to manage his/her own task effectively. They should also develop their study and learning skills, as new technologies will be emerging from time to time and there is a need for professionals in the field to cope with rapid changes.

#### Overall Expectations

In summary, students should be able to:

- Capture, create, process or optimise the different kinds of multimedia elements for presentation in different contexts;
- Understand and apply practical considerations for incorporating multimedia elements into a presentation;
- Understand and apply design factors for presenting information effectively on the Internet;
- Use a web authoring tool and the associated web authoring skills to present information and to collect information on the Internet, including a basic understanding of concepts related to the construction of dynamic web pages;
- Use the Hypertext Markup Language (HTML) in the construction or modification of web pages;
- Describe briefly the recent developments in the markup languages;
- Describe briefly the requirements for web hosting; and
- Use a File Transfer Protocol (FTP) program and other appropriate tools to manage a web site.

The time allocation for the elective is about 30 hours.

## Details of the Elective

The elective *Multimedia Production and Web Authoring* comprises three topics, namely '*Multimedia Production*', '*Design Factors for Presenting Information on the Internet*', as well as '*Web Authoring and Simple Web Management*'. Further information on the three topics is summarised as follows:

| Topics   | Remarks   |
|--|---|
| <b>A. Multimedia Production</b>  |   |
| <ul style="list-style-type: none"><li>• Use of<ol style="list-style-type: none"><li>1. Text</li><li>2. Graphics</li><li>3. Audio Information</li><li>4. Animations</li><li>5. Videos</li></ol></li></ul> | <ul style="list-style-type: none"><li>• Students should understand the basic concepts related to the different multimedia elements. They should be able to<ul style="list-style-type: none"><li>➤ make a distinction among them (e.g. between bitmaps and vector graphics, between wave files and midi files, etc.);</li><li>➤ change the attributes of the multimedia elements according to given needs (e.g. the font size and typeface of text, the colour scheme of graphics, the amount of details for digital information, etc.);</li><li>➤ convert the same kind of multimedia elements from one file type to another;</li><li>➤ perform simple editing and processing (e.g. changing the sharpness and brightness of graphical images, applying filters to give special effects, performing simple editing and mixing of wave files, performing simple video editing, etc.).</li></ul></li><li>• Students should be able to<ul style="list-style-type: none"><li>➤ use scanners, digital cameras, screen capture, etc. to capture digital images;</li><li>➤ construct simple vector graphics using a graphic utility;</li><li>➤ use features of a sound card to capture audio information;</li><li>➤ construct simple animation, such as the animated Graphics Interchange Format (animated GIF) and animations involving characters changing against a static background, using appropriate software.</li></ul></li><li>• Common concepts among different multimedia elements</li><li>• Students should understand the meaning of digitisation and compression, and the need to strike a balance between the file size and the resolution in processing multimedia elements. They should also be aware that such concepts are common to the different multimedia elements.</li></ul> |
| <b>B. Design Factors for Presenting Information on the Internet</b>  |   |
| <ul style="list-style-type: none"><li>• Planning and designing the file structure of the web site</li><li>• Planning and designing the use of the workspace available on each page</li></ul>             | <ul style="list-style-type: none"><li>• Students should have sufficient exposure to planning and designing web pages for them to generate the required concepts.</li></ul>  |

| Topics  | Remarks  |
|---|--|
| <ul style="list-style-type: none"> <li>Practical considerations in the construction of web pages</li> </ul> | <ul style="list-style-type: none"> <li>Students should be aware of the following practical considerations in the construction of web pages: <ul style="list-style-type: none"> <li>➤ Use of a colour scheme</li> <li>➤ Grouping information into tables and lists</li> <li>➤ Using frames</li> <li>➤ Providing details in downloadable files or other pages</li> <li>➤ Using meaningful contextual links</li> <li>➤ Using graphics, audio files and animation appropriately</li> <li>➤ Taking into consideration differences in common browsers</li> <li>➤ Date-stamping the documents</li> <li>➤ Providing channels for feedback</li> <li>➤ Structuring the contents for easy printing</li> </ul> </li> </ul> |
| <ul style="list-style-type: none"> <li>Catering for different users</li> </ul>                              | <ul style="list-style-type: none"> <li>Students should be aware that information on the Internet is to be accessed through means other than a browser in a computer.</li> <li>Students should be aware that there are guidelines to cater for web accessibility by people with special needs.</li> </ul>   |

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### *C. Web Authoring and Simple Web Management*

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|--|--|
| <ul style="list-style-type: none"> <li>Basic understanding of web authoring tools</li> </ul>             | <ul style="list-style-type: none"> <li>Students should know that there is a variety of tools available for web authoring and should be aware of their major differences. They are not required to have a complete understanding of all the functions of these tools.</li> </ul>  |
| <ul style="list-style-type: none"> <li>Further understanding of markup languages</li> </ul>              | <ul style="list-style-type: none"> <li>Students should know that there are different markup languages developed for different purposes. They should also be aware of the recent developments in the markup languages.</li> <li>Students should be able to apply an understanding of HTML to edit or perform fine-tuning of web pages.</li> </ul>                 |
| <ul style="list-style-type: none"> <li>Presenting information using special constructs</li> </ul>        | <ul style="list-style-type: none"> <li>Students should be able to <ul style="list-style-type: none"> <li>➤ use lists and tables for presenting information;</li> <li>➤ use frames to split up the workspace;</li> <li>➤ embed multimedia elements for enriching the presentation;</li> <li>➤ use links and anchors to relate information.</li> </ul> </li> </ul> |
| <ul style="list-style-type: none"> <li>Using Mailto and Fill-out Forms to collect information</li> </ul> | <ul style="list-style-type: none"> <li>Students should be aware that there is a variety of ways to collect feedback. In order that feedback can be collected and responses be given afterwards, there are programs and mechanisms in the servers to process the information.</li> </ul>  |
| <ul style="list-style-type: none"> <li>Introduction to dynamic web pages</li> </ul>                      | <ul style="list-style-type: none"> <li>Students should understand the meaning of web posting and web hosting, and have the experience of posting web pages with a tool such as an FTP program.</li> <li>Students should be aware that server-side computing is needed in dynamic web pages.</li> </ul>   |

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## III. Learning and Teaching

### Introduction

This curriculum and assessment guide is among those subject guides issued after the publication of the CDC Report on 'Learning to Learn - The Way Forward in Curriculum Development' (2001). It is expected that there will not only be the latest updating of the curriculum contents but also an enhancement of the learning and teaching occurring in schools. The aims and objectives of the curriculum listed at the beginning of this guide show clearly that there is a change from a content-based curriculum to one emphasizing a variety of learning experiences and learning outcomes. This chapter gives further elaboration, including guidelines and clues, on how to bring about effective learning and teaching in schools.

### Guiding Principles

In general, the learning and teaching of the S4-5 Computer and Information Technology Curriculum should be based upon the following guiding principles:

- (a) Learning for the preparation of individuals to cope with the rapidly changing technological world
- (b) Learning according to the interest, aptitude and ability of students
- (c) Learning through structured tasks and authentic situations
- (d) Progressive learning through appropriate feedback and assessment

Accordingly, teachers are expected to assume the roles of a facilitator, rather than the roles of a conventional instructor who teaches and assesses the performance and progress of students only. A facilitator is to be:

- (a) A leader in students' learning process
- (b) A trainer of enabling skills
- (c) A resource consultant
- (d) An energiser of the learning process

The sections below give further elaboration of these concepts. Appropriate highlights from the curriculum framework will be presented to show how the design of curriculum has already incorporated these ideas.

## Learning to Cope with the Rapidly Changing Technological World

Learning is now regarded as the process of constructing knowledge whereby the learner participates actively in the process of creating meanings to new experiences gained and relating them to established ones. Modern ways of learning emphasise the importance of:

- active participation,
- ownership of the learning process,
- authentic learning experiences,
- relevance to life,
- learning the basic transferable skills together with the domain-specific knowledge,
- frequent interaction and discourse with people,
- life-wide learning for gaining more new experiences, etc.

The learning of computer and information technology follows similar trends and has been particularly challenging as:

- (a) computer and information technology has become an integral part of our everyday life and there can both be learning opportunities and learning challenges everywhere, and
- (b) computer and information technology has been advancing at so rapid a pace that it is difficult to define what should be learnt and what ought not to be learnt.

To turn challenges into opportunities, the design of the computer and information technology curriculum has already included the following characteristics to facilitate student learning:

- Learning the basic concepts as a start to lay a firm foundation
- Learning the generic enabling skills as a support for further development
- Learning to develop the desirable values and attitudes for sustaining student learning
- Learning to learn as one of the ultimate goals

The grouping of the fundamental stable elements of the curriculum into a core module is a measure to put things into practice. The emphasis on communication and presentation skills, problem solving skills, software-independent IT skills, students' ability to select the appropriate tools to perform a given task, their ability to critically analyse the objectives of a program or the algorithm before constructing one, etc., are other means to meet the needs. There are also the specialised study of the social implications of computer and information technology, the incorporation of student coursework as a basic requirement of the curriculum, etc. They are other ways to prepare students to be an active learner and an active participant in the future technological world.

Students are expected to take into account such considerations in planning and conducting their studies. They should also be sensitive to and watchful of recent developments and may try to:

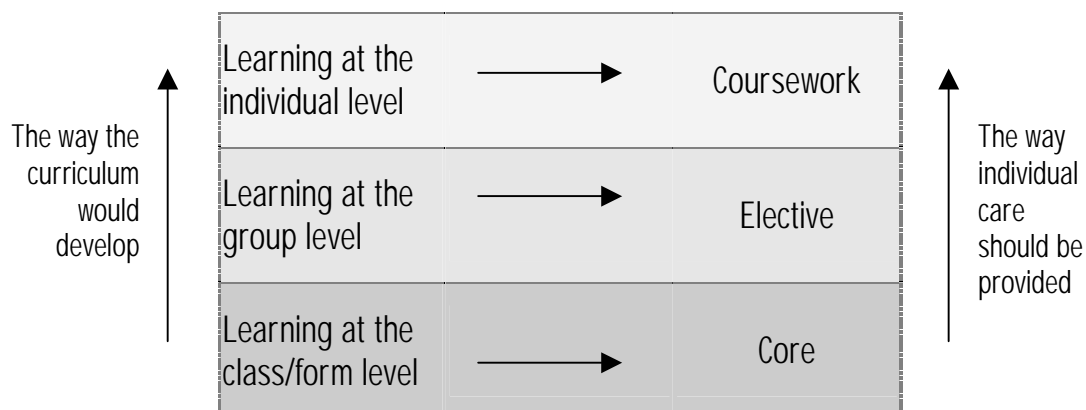
- develop the habit of reading IT periodicals and magazines so as to know more about future trends and recent developments,
- relate these trends and developments to their basic concepts and skills acquired,
- make full use of the knowledge network available on the Internet to enrich their studies,
- develop the habit of reading and analysing the source codes of different programs and web pages to know more about how the same problem can be solved using different strategies and how a solution can be improved,
- experience the use of different tools and methods to perform the same task, and
- engage in more hands-on activities of different nature such as the Do-It-Yourself (DIY) workshops, web page design competitions, etc. to gain more exposure and experience.

These are not mandatory requirements of the curriculum. However, they are the pragmatic ways students can help themselves in coping with technological changes. They are also ways to stretch the full potential of the gifted students.

## Learning according to Individual Interest, Aptitude and Ability

Since the implementation of the IT in Education project, there has been the realization that the learning needs and learning abilities of students show great variation. Furthermore, computer and information technology has now grown to so vast an area that it is difficult for a student to learn all relevant contents within a given period of time.

The design of the curriculum has taken into account such constraints in the first place. Nonetheless, the curriculum has also recognised the importance of learning according to individual interest, aptitude and ability and has put due emphasis on learning according to individual needs. Basically, with the availability of the elective modules and the incorporation of the students' coursework, there can be three levels of learning and students should be given more and more individual care as the curriculum is being taught:



The above arrangements however do not preclude the need of providing individual students, whether gifted or less achieved, particular attention. Teachers may also be varying the amount of curriculum time allocated to the core, elective and coursework for individual students to meet their needs.

In this connection, it should be aware that each learner learns with his/her own style. Some learn best through teacher's exposition while others learn best through trial-and-error and in handling tangible tasks. Some learn best through having an overview of the contents first while others learn best through the progressive mastery of the foundation items, such as the functionalities of the implementation tool. Though there are always good teachers who can explain clearly, it does not mean that students learning through this style need less the practical tasks. In fact, the hands-on experience helps to reinforce what the students have learned in class lectures. It also helps to develop students into active learners capable of learning in a variety of ways. Likewise, though the teaching and learning of the tools in writing programs and in developing applications can be more systematic and many students learn easily through this style, teachers should be aware that students should have enough exposure to thinking in a holistic manner and handling tasks in an independent way, including defining the task himself or herself, choosing the appropriate tool to solve the problem, etc. The latter, as mentioned, are among the goals of the curriculum. All in all, teachers may have to adjust their teaching approaches from time to time, maintaining an appropriate balance between the better learning styles of students and the need to develop students into individuals capable of learning to learn and working independently.

Broadly speaking, in studying the present curriculum, students might be:

- learning to prepare themselves for further academic advancement, or
- learning to prepare themselves for migration into the workplace.

Students can also be:

- learning primarily the hardware aspects and the associated problem solving techniques, or
- learning for creative software or web page development.

There is however no direct relationship regarding which module serves which purpose. Even for modules that appear to be more practical, the contents covered in the curriculum remain those at the elementary level and there are always areas for advanced study. The study of the hardware components and the study of the software are also not mutually exclusive. In many cases, the study of the software has to take account of cross-platform issues. The performance of the hardware can also be optimised through an appropriate understanding of its drivers. Students should note their inclination and plan their study accordingly. Schools as far as possible should offer not only one elective. They can plan together with students the electives offered and make full use of the curriculum space provided to cater for individual needs.

The student coursework is an important means of encouraging individualised learning. Students are advised to give sufficient attention to the conduct of the coursework study.

## **Learning through Structured Tasks and Authentic Situations**

Conventional computer courses, in particular those related to programming using procedural languages, stress the importance of structured tasks to facilitate student learning. Student learning in this curriculum follows similar trends, and is expected to be further enhanced through:

- the use of authentic tasks, where students are challenged with tasks that simulate real life situations (e.g. designing web pages for the tuck shop of the school, setting up a local area network (LAN) for the library),
- day-to-day problem solving, where students are introduced to real life examples regarding how problems in the business world or society are solved using computer and information technology (e.g. inviting IT personnel from the commercial sector to share with students the importance of data integrity and how data integrity is maintained),
- integrated learning, where students apply IT skills acquired in this curriculum to the study of other subjects (e.g. using presentation skills in project-based learning of other subjects), etc.

These opportunities help to give students:

- more practice of what they have learned,
- a deeper understanding of computer and information technology,
- further understanding of how computer and information technology affects our life, and
- more exposure to learning to learn and real life problem solving.

They in turn help to prepare students to become technologically literate.

## **Progressive Learning through Appropriate Feedback and Assessment**

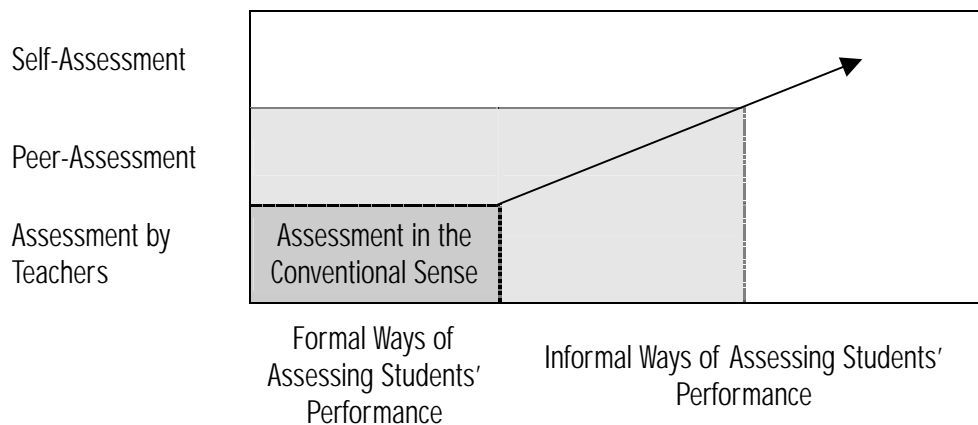
Learning, teaching and assessment are not independent processes. Student learning can be improved through constant appropriate feedback. The feedback can be from:

- teacher-student interactions,
- peer interactions,
- self-reflection,

- teacher's comments and responses to student's work,
- peer evaluation of student's work,
- self-evaluation, etc.

There are formal and casual ways of providing and collecting feedback.

In conventional classroom situations, teachers and students are accustomed to teacher-led and formal ways of providing feedback, typically through given assignments. In developing students' learning to learn ability, students need to master their own evaluation skills, including performing regular self-evaluation and self-adjustment. Teachers are encouraged to move from a teacher-led assessment culture to one encouraging constant feedback from all possible dimensions. Students should not be afraid of being judged. They should develop the ability to communicate clearly the strengths and weaknesses of their own or others' solutions for generating directions for improvement. There should be more and more informal assessments to nourish the required culture.



Developing An Assessment Culture Conducive to Learning to Learn

The frequency and the amount of feedback given to students can vary. The crux is the somber response to such feedback for continuous improvement.

In using assessment to improve performance, there can also be:

- use of teachers' comments on an individual's work to help to improve the performance of a group or the whole class through generalization, and
- use of alternative solutions which often occur in solving computer and information technology problems, whether clever or unintelligent ones, to help to enrich the exposure of students.

Teachers can use these alternatives wisely. Further elaboration on examination aspects of Assessment will be given in the chapter that follows.

## Roles of Teachers

As mentioned at the beginning, the roles of teachers are expected to be different in the delivery of this curriculum. They will be instructors explaining to students the basic concepts required and arranging suitable learning activities for students to acquire the relevant concepts and skills. They will be assessors evaluating students' progress and performance. Apart from these conventional roles, they will also be facilitators who will be:

- (a) a leader in the learning process and will
  - conduct strategic and operational program planning regarding where, when and how student learning should occur,
  - coordinate the conduct of the various activities, in particular if integrated learning across different subjects is involved,
  - help students define their goals, manage their time and resources, and construct knowledge from data collected and information synthesized,
  - keep every student focused in his or her individual work,
  - act as a role model for learning through continuous self-updating and self-improvement, as and whenever necessary;
  
- (b) a trainer of enabling skills and will
  - identify the enabling skills necessary for students for further improvement, e.g. the amount of hardware knowledge necessary if the focus of students' study is software-biased or the amount of software knowledge necessary if the focus of the study is hardware-biased,
  - ensure that all enabling skills required for further development are mastered by students first;
  
- (c) a resource consultant and will
  - know where additional information, resource and support for learning are available,
  - guide students regarding when and how such information, resource and support for learning can be secured;
  
- (d) an energiser of the learning process and will
  - analyse the progress of each student regularly,
  - impart momentum to the learning process whenever necessary, as learning is now mainly the responsibility of students and they may require constant encouragement,
  - be empowered from time to time by participation in refresher and enhancement courses.

## Learning and Teaching Activities

The teaching and learning of the present curriculum can be realised through the organisation of a variety of activities. There can be:

|   |   |
|---|---|
| <b>Structured Tasks</b><br>requiring the stepwise application of acquired knowledge for consolidation or for students to have an overview of how problems are being solved in real life situations  | <b>Discussions, Debates and Role Plays</b><br>for students to reflect upon the implications of technological changes and for students to develop their communication skills and presentation skills         |
| <b>Projects</b><br>for students to learn to define their own task, plan their own work, manage their own time and resources, seek relevant and timely information for developing the solution when necessary, etc., apart from the application of acquired concepts | <b>Lectures</b><br>where teachers expound the difficult concepts with students and experts in related fields giving students real life examples on how computer and information technology is being applied |
| <b>Visits</b><br>for eye-opening  | <b>Activities of a more generic nature</b><br>like designing a survey form for collecting data, etc   |

The above list is by no means exhaustive. A variety of learning and teaching activities can be used. Teachers should be aware that the curriculum is no longer for the exclusive development of computer and information processing concepts. A variety of learning outcomes is expected and students should be given the opportunities to achieve these goals.

### Additional Remarks

As the learning and teaching in this curriculum is expected to be quite different from conventional practices, teachers and students are advised to make good use of the following arrangements to maximise the effectiveness of student learning:

- Students' prior knowledge  
e.g. Some students may have enough exposure to the use of application software and the curriculum time may therefore be used more meaningfully in improving their other skills, including the communication and presentation skills.

- Cross-curricular learning opportunities  
e.g. Many other subjects may require the use of IT skills for completing the assignments or for reporting. Coordinating the organisation of these activities may help to alleviate the workload of both the teachers and the students.
- Possible links among topics in the core module as well as between the core and the elective modules  
e.g. The issue of hacking and cracking may be studied together with system and file integrity, while the basic programming concepts may be studied together with the elective 'Algorithm and Programming' if students are to select the elective.
- Flexible structure of the curriculum  
e.g. The discussion of the social implications may be subsumed in the other topics to provide meaningful contexts for discussion.
- Appropriate use of non-computer time during lessons  
e.g. There is no need to conduct all lessons in the computer room. In fact, students should be given ample time to plan and share ideas, to be engaged in cognitive or even meta-cognitive activities. Teachers should guide students to appreciate the importance of thinking and planning ahead before working in front of the computers.

As regards the time and venue appropriate to the delivery of the curriculum, teachers and students should realise that the time allocations suggested for the modules and topics are rough estimations only. Teachers are advised to adjust the time necessary according to their own needs. They may also consider the use of new timetabling arrangements to maximise the effectiveness of the time used.

Last but not least, teachers and students are encouraged to make good use of tools, equipment and resources other than the standard ones for learning and teaching. As computer and information technology has been advancing at a rapid pace, a strong reliance on standard tools, equipment and resources might hold back student learning. On the contrary, if students are given sufficient alternative exposures and experiences using a variety of free programs and open source utilities (e.g. the open source programming languages), they will be more adaptive to technological changes. Likewise, information pertaining to computer and information technology, such as the latest developments and applications of the Internet, is updated frequently on the World Wide Web. Students, in particular the brighter ones, can be directed to extend their study through carefully designed activities using these kinds of resources.



## IV. Assessment

### Introduction

Assessment is the practice of collecting evidence of student learning to provide feedback to the learners and to the learning process (assessment for learning), as well as to examine the progress of the learners so that the more appropriate strategies for the next stage of development can be planned and implemented (assessment of learning). This chapter gives further elaboration of these concepts and the assessment strategies recommended for the curriculum.

### Guiding Principles

In general, as assessment should reflect clearly the curriculum aims, there should be modes, means and strategies that capture the following aspects of the curriculum in the first place:

- Students' understanding of the prescribed concepts
- Students' ability to apply concepts and skills
- Students' problem solving, critical thinking and communication skills, as well as their self-learning abilities
- Students' appraisal of the impact of computer and information technology
- Students' development of the appropriate values and attitudes for learning and using computer and information technology

There should also be an adequate balance between assessment for learning and assessment of learning, reflecting a close integration of the learning, teaching and assessment processes and our current understanding of the roles and functions of assessment.

Lastly, as assessment in the present curriculum has to be linked with the public examination, a number of practical constraints have to be taken into account in planning and designing assessment strategies for the curriculum.

The following sections explain each of the above aspects. They will be used for guiding the construct of the public examination. They could also be used as references for implementing school-based assessment strategies.

In short, conventional ways of perceiving assessment should be expanded and a new assessment culture conducive to learning to learn should be developed both at the school level and at the public examination level.

## Assessment reflecting Curriculum Aims

Conventional paper-and-pen examinations have their own merits. They are good for examining students' attainment in the knowledge domain, in particular for comparison purposes, whether used in comparison with prescribed standards or in categorising students into different performance bands for further selection. With well-constructed objective-type questions, there can be a good sampling of the contents taught and a reliable means for evaluating learners' differences in the knowledge domain. With well-designed structured questions, in particular contextual ones, there can also be a reasonable assessment of students' ability to apply acquired concepts, their use of the problem solving skills and critical thinking skills, as well as their communication skills. As such, the conventional paper-and-pen examination will continue to be one of the means for assessing students' performance and progress in the present curriculum.

Paper-and-pen examinations however are known to be defective in assessing values and attitudes, most practical skills, the learners' learning ability, their personal growth in areas such as creativity, inter-personal skills, aesthetic sense, career awareness, etc. Not all of these attributes are the major focuses of the present curriculum, but new ways of assessing students' performance and progress have to be incorporated to truly reflect students' attainment in the present curriculum. The present curriculum therefore advocates the incorporation of the students' coursework as a means to complement the conventional paper-and-pen examinations.

Broadly speaking, the above two assessment methods serve the following different purposes:

| <i>Paper-and-pen Examination</i>  | <i>Coursework</i>   |
|---|---|
| <ul style="list-style-type: none"><li>• Understanding of concepts</li><li>• Ability to apply concepts and skills</li><li>• Problem solving, critical thinking, communication skills (to a certain extent)</li><li>• Appraisal of impact (to a certain extent)</li></ul> | <ul style="list-style-type: none"><li>• Understanding of concepts</li><li>• Ability to apply concepts and skills</li><li>• Problem solving, critical thinking, communication skills</li><li>• Self-learning capability</li><li>• Appraisal of impact</li><li>• Values and attitudes</li></ul> |

Other modes and methods of assessment will be incorporated to better reflect the curriculum aims, when teachers and students are accustomed to the new assessment culture. The weighting of the different modes and methods can also be adjusted pending teachers' ability to administer the new assessment methods successfully.

It must be mentioned that coursework assessment is a purposely built mechanism to assess attributes that are hard to be assessed using the conventional paper-and-pen method, such as students' practical skills, process skills, values and attitudes, etc. It also provides a good means for putting assessment for learning into practice, the latter being a concept central to the curriculum and will be elaborated in the next section.

Guidelines on how to conduct coursework assessment will be provided in other related documents published by the HKEAA. Teachers and students should refer to these documents for further information.

## Assessment for Learning and Assessment of Learning

Based upon new views about learning, alternative approaches to assessment, which focus on assessment *for* learning rather than assessment *of* learning, are being developed and implemented worldwide. These approaches in general have the following characteristics:

- Involving challenging tasks that invite the use of a variety of skills
- Looking for the best performance rather than lower thresholds
- Addressing the learning process as well as the learning outcomes
- Being an on-going process
- Making expectations visible to students
- Having different expectations for different students in accordance with their learning needs
- Actively involving students in evaluating their own work
- Informing students of their strengths and weaknesses
- Informing teachers of the strengths and weaknesses of the teaching process

As the present curriculum encourages a change in the learning and teaching occurring inside classrooms, many of these concepts apply in the assessment of the present curriculum.

It is however understood that with the need to maintain the credibility of the public examination and unless the change in the assessment culture has been fully developed, not all of these concepts apply equally well in the public examination for the present curriculum. It is advisable therefore that teachers can make full use of these principles in:

- (a) developing internal assessment strategies for their own students, and
- (b) for the coursework assessment component of the public examination.

To be specific, in implementing strategies for 'assessment for learning', including the assessment of students' coursework in the public examination, teachers may include the following elements (or stages of development) for its realisation:

- Helping students to conceptualise and define their own problems
- Helping students to define their criteria for success
- Helping students to define their own work schedules
- Helping students to collect evidence of their learning and document the evidence so that they know they have been making progress
- Helping students to reflect upon what they have achieved and check their own progress from time to time
- Helping students to evaluate what they have accomplished at the end

The above framework contrasts drastically with conventional 'assessment of learning' methods. Teachers should bear in mind that the standards of performance are to be developed by them together with the students. The outcomes of learning are no longer of the sole concern. Students should be responsible for understanding the assessment criteria, performing self-evaluation from time to time and re-adjustment in case of necessity, in order to achieve the pre-set goals.

Even with such an assessment framework, students with different abilities and aptitudes will perform differently and there can always be a distinction in the final grading process.

In implementing assessment for learning strategies, it is important that teachers are there to help and to facilitate. They are not there to do the task or problem solving for the student. They should also guide students to stretch their full potential, instead of just meeting the basic requirements.

As a head start, assessment criteria for students' coursework will be developed for use in the public examination. They are not meant to be absolute standards. They will be revised in the light of experiences gained. Teachers may use these assessment criteria as reference for constructing criteria for internal assessment. They can also be adjusted to meet individual needs and for specific purposes in internal examinations.

Students can be given these criteria for performing their own self-evaluation. Feedback in the form of a grade or any other indicator, written or verbal comments, by peers or by the teachers concerned, can also be given to provide students more inputs for them to improve.

## **Additional Remarks for the Public Examination**

The above elaboration is an attempt to illustrate clearly how assessment can be improved to integrate closely with the teaching and learning processes for the benefit of students. It should not be treated as an over-simplification of the overall assessment. Teachers and students should be aware that the integrity of the public examination system should be respected.

Before the firm establishment of a new examination culture, teachers and students should still be aware of issues such as reliability, comparability, credibility, etc. for the public examination system and should endeavor to maintain them, despite the fact that part of the public examination is now school-based.

Teachers however should have elements of assessment for learning built into their internal assessment and accustom students to the practice of assessment for learning, including the criteria setting process, self-evaluation and the use of frequent feedback to inform learning needs. With these at hand, students will be better equipped for the challenges in their coursework for the public examination.

Other relevant information for the public examination, including the examination rubrics, is available in relevant documents and handbooks provided by the HKEAA.



## V. References

### Reference Books for the core module:

| Title  | Author            | Publisher               | ISBN       | Year of Publication |
|--|-------------------|-------------------------|------------|---------------------|
| A Gift of Fire: Social, Legal, and Ethical Issues in Computing (2 <sup>nd</sup> Edition) | Sara Baase        | Prentice Hall           | 0130082155 | 2000                |
| Concepts of Programming Languages (5 <sup>th</sup> Edition)                              | Robert W. Sebesta | Addison-Wesley          | 0201752956 | 2001                |
| How the Internet Works   | Preston Gralla    | Que                     | 0789725827 | 2001                |
| HTML: A Beginner's Guide   | Wendy Willard     | McGraw-Hill             | 0072130261 | 2000                |
| Information Technology: The Breaking Wave  | Dennis P. Curtin  | McGraw-Hill             | 0256218471 | 1998                |
| Internet Search Techniques (3 <sup>rd</sup> Edition)                                     | Karin Rex         | Element K               | 0758028814 | 2001                |
| New Perspectives on Computer Concepts (5 <sup>th</sup> Edition)                          | Dan Oja           | Course Technology, Inc. | 0619044195 | 2001                |
| 電腦入門與探討  | 黃明達               | 全華圖書                    | 9572135732 | 2002                |
| 電腦概念與應用  | 林東賢, 朱奐玫          | 知城                      | 9867845250 | 2002                |
| Computer Virus 百毒防治  | 陸金山、王岩增           | 萬里機構                    | 9621425182 | 2002                |
| 全圖傳意倉頡碼字典  | 吳家琪               | 萬里機構                    | 9621415098 | 1999                |

### Reference Book for the elective modules:

#### (A) Algorithm and Programming

| Title  | Author                         | Publisher      | ISBN       | Year of Publication |
|--|--------------------------------|----------------|------------|---------------------|
| Schaum's Outline of Programming with Pascal  | Byron Gottfried                | McGraw Hill    | 007023924x | 1994                |
| C: A Reference Manual (4 <sup>th</sup> Edition)                                    | Samuel P. Harbison             | Prentice Hall  | 0133262243 | 1994                |
| C Programming FAQs: Frequently Asked Questions                                     | Steve Summit, Deborah Lafferty | Addison-Wesley | 0201845199 | 1995                |
| Computer Algorithms: Introduction to Design and Analysis (3 <sup>rd</sup> Edition) | Sara Baase, Allen Van Gelder   | Addison-Wesley | 0201612445 | 1999                |

| <b>Title</b>                         | <b>Author</b>       | <b>Publisher</b>          | <b>ISBN</b> | <b>Year of Publication</b> |
|--------------------------------------|---------------------|---------------------------|-------------|----------------------------|
| Essentials of C Programming Language | Ernest C. Ackermann | Research & Education Assn | 0878916962  | 1998                       |
| Turbo Pascal 入門與應用徹底剖析               | 洪錦魁                 | 松崗                        | 9572212125  | 1998                       |
| PASCAL 程序設計 (第二版)                    | 鄭啟華                 | 清華大學出版社                   | 7302020043  | 1996                       |
| C 語言入門 (附 CD)                        | 林邦傑                 | 知城                        | 9867845013  | 2002                       |
| C 語言程式設計基礎                           | 李成付 陳世鴻 劉良 觀        | 儒林圖書                      | 9576526590  | 1994                       |
| 資料結構理論使用 C 語言                        | 溫惠美                 | 博碩文化                      | 9575275306  | 2002                       |

### Reference Book for the elective module: (B) Organisation of Computer

| <b>Title</b>  | <b>Author</b>        | <b>Publisher</b>  | <b>ISBN</b> | <b>Year of Publication</b> |
|---|----------------------|-------------------|-------------|----------------------------|
| Computer Organization and Architecture (6 <sup>th</sup> Edition)  | William Stallings    | Prentice Hall     | 0130351199  | 2002                       |
| Operating System Concepts (6 <sup>th</sup> Edition)   | Abraham Silberschatz | Prentice Hall     | 0471417432  | 2001                       |
| The Architecture of Computer Hardware and System Software: An Information Technology Approach (2 <sup>nd</sup> Edition) | Irv Englander        | John Wiley & Sons | 0471362093  | 2000                       |
| 乙級檢定電腦硬體裝修術科詳解  | 林源富                  | 碁峰                | 9864212311  | 2003                       |
| 系統加速、效能校調實戰 DIY   | 亦向工作室                | 碁峰                | 986421151X  | 2002                       |
| 電腦救援徹底學通  | 陳永澤、鄭伯鴻              | 電腦人文化             | 9867922107  | 2002                       |

### Reference Book for the elective module: (C) Data Communications and Networking

| <b>Title</b>   | <b>Author</b>     | <b>Publisher</b> | <b>ISBN</b> | <b>Year of Publication</b> |
|--|-------------------|------------------|-------------|----------------------------|
| Understanding Data Communications                          | Gilbert Held      | Addison-Wesley   | 0672322161  | 2002                       |
| Data and Computer Communications (6 <sup>th</sup> Edition) | William Stallings | Prentice Hall    | 0130843709  | 1999                       |

| <b>Title</b>  | <b>Author</b> | <b>Publisher</b>        | <b>ISBN</b> | <b>Year of Publication</b> |
|---|---------------|-------------------------|-------------|----------------------------|
| Data Communications and Computer Networks: A Business User's Approach (2 <sup>nd</sup> Edition) | P. Pratt      | Course Technology, Inc. | 0619064641  | 2002                       |
| 區域網路安裝、架設、上網一次搞定亦向工作室   |               | 暮峰                      | 9864211730  | 2002                       |
| TCP/IP 概論   | 普悠瑪數位科技       | 五南                      | 9571128910  | 2002                       |
| 電腦網路  | 顏春煌, 黃仁竑      | 空中大學                    | 9576614783  | 2002                       |
| 電腦網路與資料通訊   | 王聖傑           | 知城                      | 9572005413  | 2001                       |

### Reference Book for the elective module: (D) Multimedia Production and Web Authoring

| <b>Title</b>   | <b>Author</b>                    | <b>Publisher</b>                    | <b>ISBN</b> | <b>Year of Publication</b> |
|--|----------------------------------|-------------------------------------|-------------|----------------------------|
| Building Effective Web Sites   | Raymond Frost, Judy Strauss      | Prentice Hall                       | 0130932884  | 2001                       |
| Designing Web Usability: The Practice of Simplicity                  | Jakob Nielsen                    | New Riders                          | 156205810X  | 1999                       |
| Learning Web Design: A beginner's Guide to HTML, Graphics and Beyond | Jennifer Niederst, Richard Koman | O'Reilly & Associates, Incorporated | 0596000367  | 2001                       |
| Multimedia Concepts: Illustrated Introductory                        | James E. Shuman                  | Course Technology, Inc.             | 0619017651  | 2001                       |
| Multimedia: Concepts and Practice and Student Book & CD-ROM          | Stephen McGloughlin              | Prentice Hall                       | 0130575062  | 2001                       |
| Multimedia: Making It Work   | Tay Vaughan                      | McGraw-Hill                         | 0072190957  | 2001                       |
| Web Accessibility for People with Disabilities                       | Michael G. Paciello              | C M P Books                         | 1929629087  | 2000                       |
| Web Style Guide: Basic Design Principles for Creating Web Sites      | Patrick J. Lynch, Sarah Horton   | Yale University Press               | 0300076754  | 1999                       |
| 電腦動畫基礎   | 吳鼎武、瓦歷斯                          | 松崗                                  | 9572229699  | 1998                       |
| 多媒體概論 — 數位影像處理、3D 動畫   | 王啟榮                              | 文魁                                  | 9746647405  | 2002                       |
| 多媒體製作與應用 — 網頁、教學、遊戲  | 木棉坊工作室                           | 文魁                                  | 9574666255  | 2002                       |
| 多媒體技術基礎與應用   | 鄂大偉                              | 高等教育出版社                             | 704010119X  | 2001                       |

## Reference books for further enrichment:

| Title  | Author                              | Publisher                        | ISBN       | Year of Publication |
|--|-------------------------------------|----------------------------------|------------|---------------------|
| Database Systems: A Practical Approach to Design, Implementation, and Management (3 <sup>rd</sup> Edition) | Thomas M. Connolly, Carolyn E. Begg | Addison-Wesley                   | 0201708574 | 2001                |
| Java How to Program (4 <sup>th</sup> Edition)  | Harvey M. Deitel, Paul J. Deitel    | Prentice Hall                    | 0130341517 | 2001                |
| The C++ Programming Language (3 <sup>rd</sup> Edition)   | Bjarne Stroustrup                   | Addison-Wesley                   | 0201700735 | 2000                |
| The Complete C++ Training Course   | Harvey M. Deitel, Paul J. Deitel    | Prentice Hall                    | 0130895644 | 2000                |
| Create Dynamic Web Pages Using php and Mysql (with CD-ROM)   | David Tansley                       | Addison Wesley                   | 0201734028 | 2001                |
| Multimedia and the Web: Creating Digital Excitement  | Calleen Coorough                    | Dryden Press                     | 0030321883 | 2001                |
| Security in Computing (2 <sup>nd</sup> Edition)  | Charles P. Pfleeger                 | Prentice Hall                    | 0133374866 | 1996                |
| The Art of 3-D Computer Animation and Imaging  | Isaac V. Victor Kerlow              | Wiley, John & Sons, Incorporated | 047136004X | 2000                |
| C++ 程式設計樣式揭密   | 葉涼川                                 | 培生教育                             | 9867790502 | 2002                |
| 資料結構理論—使用 Java   | 柯溫釗                                 | 博碩文化                             | 9575275527 | 2002                |
| PALM 程式設計入門(附 CD)  | 鄭元飛                                 | 碁峰資訊                             | 730204158X | 2001                |
| 數位影像處理   | 蕭進松                                 | 全華科技                             | 9572124455 | 1999                |

Online resources are also available on the homepage for Computer Education under the Technology Education Key Learning Area of the Curriculum Development Institute, Education and Manpower Bureau (<http://cd.emb.gov.hk/kla/kla.asp?subject=computer>).

## VI. Appendix

As at the time this curriculum and assessment guide is finalised, it is agreed that the C Language and the Pascal Language will be used in parallel in the written examination for the 'Algorithm and Programming' module. The programming language(s) used will be reviewed after two years.