THE ASSOCIATED EXAMINING BOARD

for the General Certificate of Education

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COMPUTER STUDIES - ORDINARY LEVEL (MODE 2)

The numbering of sections of the syllabus does not imply an order of treatment.

Section 1 - Background and Development

1.1.	A brief summary of calculating and clerical aids from the abacus to the present day with particular reference to contemporary machines and devices.	This summary should highlight the differences between calculators (both mechanical and electrical) and computers.
1.2	The introduction of the punched card as a means of data storage.	The need for a new form of data storage to handle the rapidly increasing requirements by the late 19th century should be emphasised. The 1890 U.S.A. census and Hollerith's contribution.
1.3	The concept of a stored program.	The way program data is put in and stored (the pidgeon hole approach). Illustrate the need for a stored program with reference to Babbage's work and Lady Lovelace's ideas on iterative programming. Aitken's work on ASCC should also be mentioned.
1.4	Early computers: developments since 1945.	The Von Neumann report provides the basis for conventional computer design, and the major recommendations should be mentioned (numeric order codes, stored programs, minimum storage, internal binary representation). A brief comparison between an early machine such as EDSAC and a modern machine in terms of speed, size, hardware, peripheral features would be useful.

Section 2 - Information Processing

2.1	Manual methods and mechanical aids in the modern office. Basic commercial procedures and terminology. Addlisting and accounting machines. Collection and organization of data. Appreciation of form design, graphs and charts. Files and their structures - manual updating of a simple master file.	The aim should be to give the students an understanding of simple office routines and equipment so that they are better able to appreciate the place of a computer in the eventual overall system.

2.2	Punched card processing: the key punch, sorter and tabulator. Card creation and arrangement. Fields and records. Verification sorting and batching. Idea of check sums and batch totals. Applications of card processing. Visible record computers.	This section should show how some of the systems mentioned in 2.1 have been mechanised with the consequent need for systematic data preparation and accompanying checks.
2.3	Electronic data processing: the introduction of the computer to the previously discussed systems. Scientific and mathematical applications. Data capture and computer input preparation. Relative merits of input, storage and output methods.	The difference in computer systems for use in the applications of 2.1 and 2.2 and those used for scientific and mathematical work should be discussed.
2.4	Electronic computers in control systems: simple examples - the concept of the analog device. The difference between analog and digital methods.	It is not intended that there should be discussion of analog computers as such, but rather that a comparison be made between analog and digital methods of presenting information e.g. with description of analog devices restricted to discussion of instruments such as slide rules.

Section 3 - The Structure and Organisation of a Digital Computer Configuration

3.1	Basic computer configuration: introduction to input, output, storage and arithmetic unit: function of the control unit: definitions of address, character, byte, zone, parity.	This section should give students familiarity with some common computing terminology. The differences between a calculator and a computer must be stressed and it would be useful to compare the operation of a human clerk, preparing bills for example, with that of a computer doing the same job.
3.2	Number representation and manipulation: sign conventions: fixed and floating point forms. Simple examples in dinary.	The student should be aware of the common ways of representing positive and negative numbers and be capable of performing simple fixed length calculations with them. (e.g. binary complementary subtraction). It is important that students should be familiar with the nature of floating point numbers.
3.3	Input and Output: character representation on punched cards, paper tape and magnetic tape: card and paper tape readers, magnetic tape unit, magnetic disc: mark sensing devices, M.I.C.R., O.C.R. card and paper tape punches, line printers, teletypes, V.D.U.'s. The distinction between on-line and off-line.	This section should provide information about all the more common input and output devices. Technical details about their modes of operation should be kept to the minimum required to illustrate the environments in which they are best used. Students should know approximate speeds of operation and limitations of each device.

3.4	Storage: On-line and off-line storage - magnetic core, drum, card, disc and tape: punched card and paper tape: relative merits: comparison between immediate, direct and sequential access.	A similar approach to that suggested for section 3.3 may be adopted here. It should be pointed out that the terms input, output and storage might legitimately be applied to the same device, depending on its use in particular circumstances.
*	See also sections 6.3 and 6.6	

Section 4 - Programming

4.1	The precise specification of problems: algorithms, flowcharts	Flowcharts should be used to illustrate processes in general as well as in the more specific application to program writing.
4.2	Practical programming in a low-level language.	A subset of an assembly-type language should be used to illustrate the internal working of the computer. Teaching languages (e.g. CESIL, City and Guilds Mnemonic Code etc.) are to be preferred. Programming problems should be of a simple nature and need not include character handling.
4.3	Practical programming in a high-level language. Developing and testing of programs. Diagnostic aids.	A re-examination of the stored program concept. No single language is especially recommended: the choice must be from BASIC, FORTRAN, ALGOL or COBOL. The full generality of such languages need not be exploited to avoid unnecessary complications in program writing. Emphasis should be given to the thorough testing of compiled programs by means of appropriate test data. Students should be shown how to make use of any diagnostic aids available to them.
4.4	Program documentation: need for documentation, specification of problem with flow charts, record layouts, program listing, software and hardware used, design of test data. Other user and operator instructions as required.	See note at the end of syllabus.

Section 5 - Applications of Computers:

their Social Impact

5.1	Discussion of applications in business, industry and public administration, including the study of some examples in greater detail.	This section should demonstrate the developing use of computers in the fields of industry, commerce, scientific research, medicine, education and the social sciences, so that the pupil gains a balanced view of the present usage of computers. Consideration should be given to current applications and those that have recently received the attention of the press as well as traditional

applications. Those discussed should be commensurate with the students' experienc. Every contact with local computer users such as Local Authorities, industry and commerce should be encouraged.
The teacher should be careful to point out that a computing system is not necessarily the best in all circumstances.

5.2 The impact of computers on the individual, society and communication. Future developments and their possible effects.

Section 6 - Related Mathematics

6.1 Statistics: bar charts, pie diagrams, graphs, histograms and frequency polygons and curves. Collection of data. Questionnaires and simple form design for ease of coding and analysis. Summary of a mass of data; arithmetic mean, range and standard deviation.

The statistics should be considered under two main headings: (a) the presentation of results for their easier interpretation; (b) the analysis and reliability of those results.

6.2 Boolean algebra: elementary Boolean operations AND, OR, NOT and their use in a digital computer. Elementary truth tables.

Unless a background of set algebra exists the Boolean algebra for this section can be taught directly as AND, OR and NOT functions without reference to set notation. The theory should be illustrated by simple electrical, electronic and mechanical examples.

6.3 Number bases: conversions from and to various bases: decimal, binary and octal. B.C.D. code, Binary and Octal arithmetic.

6.4 An introduction to iterative techniques.

Formulae and equations used should be kept simple. Graphical illustrations should be used.

6.5 An introduction to one- and two-dimensional arrays. The manipulator of elementary matrices up to 3 x 3.

The matrix work should not progress beyond the solution of a pair of simple simultaneous equations. The inverse may be obtained by inspection.

6.6 Sources of error in arithmetic.

The effects of round-off on simple arithmetic operations should be considered. Every opportunity should be taken to use calculating machines. This section should be related to section 3.2.

Note: Students will be required to present THREE completely documented programs. Alternatively, a project consisting of a suite of programs may be presented. 20% of the total marks will be awarded for the practical work. There will be 2 essay papers of 2½ hours each. 40% of the marks will be allotted to each paper. The marks allocated to each question will be indicated on the paper.