

National Course Specification: Course details (cont)

Intermediate 2 Computing: Computer Systems (mandatory Unit)

The candidate must demonstrate knowledge and understanding, practical skills and problem solving based on the following content statements:

Data representation

- ◆ Representation of positive numbers in binary using examples up to and including eight bits
- ◆ Advantages of using binary numbers
- ◆ Description of floating point representation of real numbers using the terms mantissa and exponent
- ◆ Description of file sizes, backing storage and main memory capacities using the terms: bit, byte, Kilobyte, Megabyte, Gigabyte, Terabyte (Kb, Mb, Gb, Tb)
- ◆ Description of the ASCII code including control characters
- ◆ Description of the term character set
- ◆ Description of bit map method of graphic representation using examples of black and white bit maps
- ◆ Calculation of storage requirements

Computer structure

- ◆ Description of the purpose of a processor
- ◆ List the parts of a processor as ALU, control unit and registers
- ◆ Representation of the structure of a computer in the form of a simple five box diagram representing: input devices, processor, main memory, output devices, and backing storage
- ◆ Distinction between main memory and backing storage
- ◆ Description of the features and uses of RAM and ROM
- ◆ Description of the uses of embedded, palmtop, laptop, desktop and mainframe computers
- ◆ Comparison of features of embedded, palmtop, laptop, desktop and mainframe computers: type and speed of processor, size of main memory, backing storage, input and output devices
- ◆ Description of clock speed as a simple indicator of system performance

Peripherals

- ◆ Description of the features, functions and uses of the following input devices: keyboard, mouse, microphone, touchpad, digital camera, scanner, webcam
- ◆ Comparison of input devices using appropriate characteristics including resolution, capacity, speed of data transfer, cost
- ◆ Description of the features, functions and uses of a monitor, LCD panel, inkjet and laser printers, loudspeakers
- ◆ Comparison of output devices using appropriate characteristics including resolution, capacity, speed of data transfer, cost
- ◆ Magnetic storage: description of the features, functions and uses of current magnetic storage devices and media including floppy drive, hard drive, zip drive, magnetic tape drive
- ◆ Optical storage: description of the features, functions and uses of current optical storage devices and media including CD-ROM, CD-R, CD-RW, DVD-ROM, rewritable DVD
- ◆ Comparison of storage devices using appropriate characteristics including type of access, capacity, speed of data transfer, cost
- ◆ Description of the need for interfaces with reference to the following functions: compensating for differences in speed between the CPU and peripherals, data conversion from analogue to digital forms and temporary data storage

Networking

- ◆ Description of the following features of LANs, WANs and the Internet: transmission media, bandwidth, geographical spread and functions

National Course Specification: Course details (cont)

Intermediate 2 Computing: Computer Systems (mandatory Unit) (cont)

- ◆ Description of the functions of a client and server on a network
- ◆ Description of the benefits of networks
- ◆ Description of the following features and functions of e-mail: e-mail address, sending, reading, replying, setting up an address book, setting up mailing lists, setting up folders
- ◆ Description of the following features of the World Wide Web: web pages, hyperlinks, browser, search engines
- ◆ Description of the following economic factors which have led to the development of computer networks: falling cost of telecommunication technologies and services, shared access to expensive equipment, geographic spread of organisations, demand for up-to-date information
- ◆ Description of the main features of the Computer Misuse Act, the Copyright Designs and Patents Act and the Data Protection Act

Computer software

- ◆ Distinction between an operating system and an application program with examples of each
- ◆ Explanation of the need for standard file formats
- ◆ Description of the following standard file formats for text files: text, ASCII, rich text file
- ◆ Identification of data objects and operations in the context of word processing, databases, spreadsheets and graphic packages
- ◆ Definition of a virus
- ◆ Description of how a virus operates
- ◆ Description of the following common symptoms of virus infection: displaying unwanted messages, unusual visual/sound effects, computers rebooting unexpectedly, unwanted generation of e-mails
- ◆ Description of how viruses are spread via floppy disk, homemade CDs, 'fun' websites and e-mail attachments
- ◆ Explanation of the need for anti-virus software

National Course Specification: Course details (cont)

Intermediate 2 Computing: Software Development (mandatory Unit)

The candidate must demonstrate knowledge and understanding, practical skills and problem solving based on the following content statements:

Software development process

- ◆ Description of the stages (in order) of the software development process: analysis, design, implementation, testing, documentation, evaluation, maintenance
- ◆ Description and exemplification of pseudocode and one graphical design notation (structure diagram or other suitable)
- ◆ Description and exemplification of appropriate test data (normal, extreme and exceptional)
- ◆ Description of the features of a user guide and a technical guide
- ◆ Evaluation of software in terms of fitness for purpose, user interface and readability

Software development languages and environments

- ◆ Description and comparison of machine code and high level languages
- ◆ Explanation of the need for translation; description of the functioning of interpreters and compilers
- ◆ Description of the process of recording a macro and assigning it to a keystroke
- ◆ Description of a macro, and examples of the use of macros
- ◆ Description of the features and use of a text editor

High level programming language constructs

- ◆ Description and exemplification of the following constructs in an appropriate high level language: input and output, assignment, arithmetical operations (+,-,*,/,^) and logical operators (AND, OR, NOT), fixed loops, conditional loops, simple and complex conditions, conditional statements (IF), nested loops
- ◆ Description and exemplification of numeric and string variables and 1-D arrays
- ◆ Description and exemplification of pre-defined functions

Standard algorithms

- ◆ Description and exemplification of the following standard algorithm in an appropriate high level language: input validation
- ◆ Recognition of appropriate use of the following standard algorithms: input validation, find min/max, count occurrences, linear search

National Course Specification: Course details (cont)

Intermediate 2 Computing: Artificial Intelligence (optional Unit)

The candidate must demonstrate knowledge and understanding, practical skills and problem solving based on the following content statements:

The development of artificial intelligence

- ◆ Description of human intelligence (including the ability to communicate, retain knowledge, solve problems)
- ◆ Description of the Turing test and explanation of its rationale
- ◆ Explanation of the need for a different approach to programming which could represent knowledge
- ◆ Simple description of the development of game playing programs from simple early examples to contemporary complex examples exhibiting intelligence
- ◆ Simple description of the development of language processing from Eliza to chatterbots and contemporary applications
- ◆ Simple description of the development of expert systems
- ◆ Identification of hardware developments (including faster processors, more memory, and increasing backing store capacity) which have assisted the development of AI

Applications and uses of artificial intelligence

Artificial neural systems:

- ◆ Simple description of a neural network as an electronic model of the brain consisting of many interconnected simple processors
- ◆ Description of uses and examples of artificial neural systems (including learning to read postcodes; stock market prediction; debt risk assessment; other examples of pattern recognition)
- ◆ Description of advantages and disadvantages of artificial neural systems

Vision systems:

- ◆ Explanation of the need to interpret/make sense of visual input.
- ◆ Description of applications (including industrial, military use, satellite photo interpretation)

Speech recognition:

- ◆ Description of applications (including word processor, punctuation commands, disabled users, cars, military, mobile phones)
- ◆ Description of characteristics (training for each voice pattern, control instructions, influence of background noise, factors affecting accuracy)

Handwriting recognition:

- ◆ Description of common applications (including palmtops and tablet PCs)
- ◆ Explanation of possible need to train the system

Intelligent robots:

- ◆ Description of types of sensors used
- ◆ Description of contemporary applications (including automated delivery, pipe inspection, bomb disposal, exploration of unknown environments)
- ◆ Description of advantages of intelligent robots

Expert systems:

- ◆ Description of purpose of expert systems
- ◆ Description of advantages of expert systems over human experts, including expertise always available, reduced wage bill, combines expertise of several experts, less chance of errors
- ◆ Description of contemporary applications of expert systems
- ◆ Description of social, legal and ethical issues related to the use of expert systems (including loss of jobs, training issues, public reactions, loss of human expertise)

National Course Specification: Course details (cont)

Intermediate 2 Computing: Artificial Intelligence (optional Unit) (cont)

Search techniques

- ◆ Exemplification of problem solving by search
- ◆ Construction of a simple search tree
- ◆ Description of breadth-first and depth-first search and exemplification on a search tree

Knowledge representation

- ◆ Construction of semantic net to represent simple relationships and facts
- ◆ Description and exemplification of the following features in Prolog (or similar declarative language): simple facts (single/double argument), simple rules (up to two sub-goals), simple queries (true/false, single variable), operators: and, >, <, =
- ◆ Explanation of the concepts of goals and sub-goals
- ◆ Perform simple manual trace: one rule/level